Harrison D. Horblit

ROLLE.

Rolle

The Effegies of
M.r Perkins

THE
Seaman's Tutor:
EXPLAINING
GEOMETRY,
COSMOGRAPHY,
AND
TRIGONOMETRY.
WITH
Requisite TABLES
OF

Longitude and Latitude of Sea-Ports, Traverse Tables, Tables of Easting and Westing, Meridian Miles, Declinations, Amplitudes, Refractions, Use of the Compass, Kalendar, Measure of the Earth's Globe, Use of Instruments and Charts, Difference of Sailing, Estimation of a Ship's Way by the Log, and Log-Line, Currents, *&c.*

Compiled for the Use of the Mathematical School in *Christ's Hospital-London*, His Majesty *Charles* II, his Royal Foundation,

By Mr. *P. Perkins*, late Master of that Mathematical School.

LONDON, Printed for *Obadiah Blagrave* at the *Bear* in S. *Paul*'s Church Yard. 1682.

To the Right Worſhipful Sir *John Frederick*, Preſident; and Treaſurer and Governors of *Chriſt's Hoſpital, London.*

WHereas *Mr.* P. P. *Mathematical Maſter of the Royal Foundation, deceaſed, left this Tutor of Navigation in great part done, and intended it for that School: it is now finiſhed by his Brother* Eyſum Perkins, *which uſed to teach that School for his ſaid Brother, which for the great*

favours be received of them, humbly presents this Tutor of Navigation.

Your most

Humble Servant

Eysum Perkins.

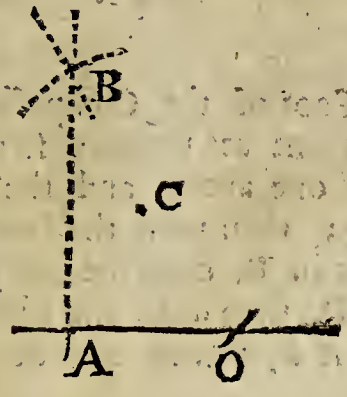
One of the Children Educated in x.ts Hospitall
Being the kings Royall gift & Foundation

THE TUTOR TO Navigation, &c.

Some Principles of Geometry.

FRom a point in a Line given to raise a Perpendicular.

Let A B be a Line given, and A the point assigned.

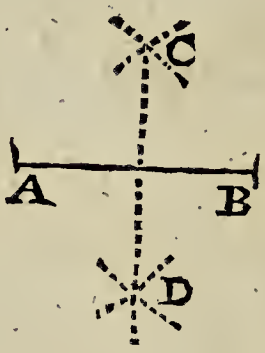


Fix one Foot of the Compasses on any con-

venient point as C, extending another to A then turning them; with that Foot at A mak an Arch at B, and another at O to croſs th Line A, B; afterwards lay a Ruler over C and C, and draw a ſhort Line, cutting th Arch B in B: Laſtly, draw B A, which wil be a *Perpendicular*, as was to be done.

2. To Biſect a Line, or to divide a Line into two equal parts.

Let A B be a Line to be divided.

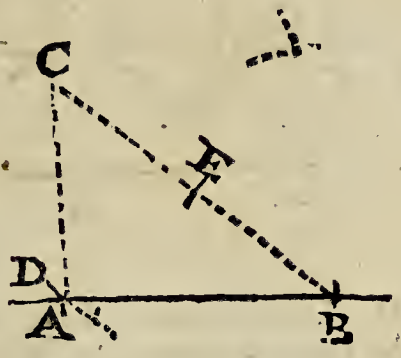


Set one Foot of the Compaſſes in A, and with any extent at pleaſure ſtrike two ſmall Arches, the one above, and the other below, as C and D; then with the ſame extent ſetting one foot in B, croſs the two former Arches in C and D, then draw the Line C D which will divide A B, as was to be done.

3. From

3. From a point aloft to let fall a Perpendicular upon a Line given.

Let A B be a ine given, and C e point propoed.

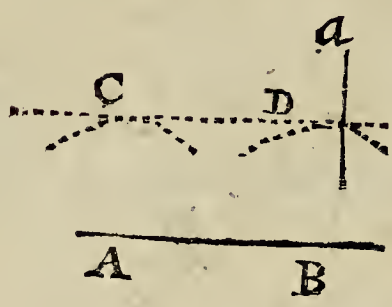


From C draw a ine, as C B, hich Line diide into two eual parts in E; en fixing 1 foot the Compaſſes E, being oened to the extent, C E, or E B, with e other Foot deſcribe the ſmall Arch D, tting the Line A B in A: Laſtly, draw Perpendicular, as was required.

Theſe are the beſt Methods for raiſing and tting fall Perpendiculars; foraſmuch as they e performed without making many, or long cratches or Arches; and they hold, let the ven point be either towards the middle or end the Line, and are ſufficient for any uſe without any other ways.

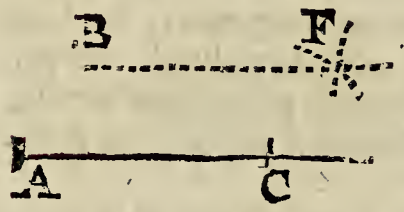
4. To draw a right Line parallel to a right ine given at any diſtance aſſigned.

Let A B be a Line given, and *a* a given di
ſtance at which it
required to draw
Line parallel t
A B: with the aſ
ſigned diſtance
ſetting one foot o
A deſcribe th
Arch C, and again
ſetting one foot o
B, deſcribe the Arch
D: Laſtly, draw a Line juſt to touch the top
of theſe Arches, as C D: then is C D a pa-
rallel to A B, and at the diſtance given *a*, a
was to be done.



5. To draw a right Line parallel to a right Line given, that ſhall paſs through a point given.

Let B be a point given through which its required to draw a Line parallel to A C.

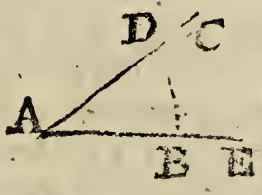


Take the diſtance A B, and therewith ſetting one foot in C deſcribe the Arch F: then with the extent A C ſetting one foot in B with the other croſs the Arch F in F: laſtly, draw B F, ſo ſhall the Line B F be parallel to A C, and paſs through the point B, as was to be done

6. To

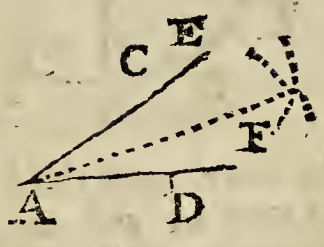
6. To make an Angle equal to an Angle gi-
n.

Let it be required at
e point E, and to the
ine F G to make an
ngle equal to the An-
e A E.



Setting one Foot in the
ngular point A with a-
y extent as A B, deſcribe
he Arch B D: then
ith the ſame extent ſet-
ng one foot in F de-
ribe an Arch as H I:
aſtly, take the extent
D, and prick it from
to I, and draw F I which ſhall make an
ngle equal to the Angle C A E as was
o be done.

7. To biſect an Angle. Let D A E be an
Ang. given. Setting one
oot in the angular
oint A with any
convenient opening
croſs the Legs in C
nd D, and with the
ame or any other con-
venient extent, ſetting
one foot in C, make with the other an Arch
at F, afterwards keeping the ſame extent, ſet
one foot in D, and with the other croſs the for-



mer Arch F in F, and draw A F, which will divide the Angle, as was required. The point F is called a point of Interſection.

8. To divide the Circumference of a Circle into eight equal parts.

Firſt, draw the Diameter A C, then with the Compaſſes opened to any extent, ſo it exceed half A C, ſet one foot in C, and with the other make an Arch above as at R, and ſetting one foot in A, with the other croſs the Arch R in R, and through the points R and E draw the Diameter F E G, which will divide the Circle into four equal parts: then again with any extent above half A F ſetting one foot on A with the other make an Arch at L, and again fixing one foot in F, with the other croſs the Arch L, and laying a Rular over L, and the point F, where the two Arches interſect make a mark on the circumference at K, ſo is A K or K F the $\frac{1}{8}$ part of the Circumference.

9. To divide the Circumference of a Circle in to thirty two equal parts.

Firſt

Firſt, Divide it into 8, as above directed, nd then divide again each of theſe parts to four, which is eaſily done by Biſection.

10. To divide the Circumference of a Circle into twenty four equal parts.

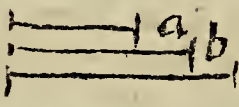
Firſt, Divide it into 8, and then each of heſe again into 3.

Or, taking the Rad. E C or E A in the Compaſſes, ſet one foot in C, and with the ther make the marks *a*, *b*, on each ſide C, hen with the ſame extent ſetting one foot in F, vith the other make the marks c, d, and fixng one foot in A, make the marks e f, and ſo on G make g h which ſhall divide the Circle nto twelve equal parts, which being divided again each into two will be 24.

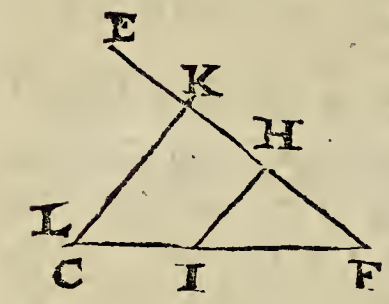
11. To divide the Circumference of a Circle into 360 equal parts.

Firſt, Divide it into 12, as in the laſt directed, and then each of theſe into 3, and each of theſe again into 10.

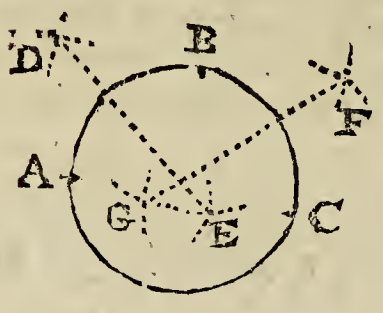
12. Three Lines being given to find a fourth proportional Line, that is, to find a fourth line which ſhall be contain'd by, or contain the third, ſo often as the ſecond is contained by, or contains the firſt.



Let a b c be three Lines given. make an Ang as the Ang. E F L, and lay the Line a from F to H, and the Line b from F to I, and draw H I: then take the third Line, C, and prick it on the ſame Line the firſt was, from F to K, and by K draw a parallel to H I, as K L; ſo ſhall F L be the fourth ptoportional required. The ground of this, and of all the Doctrine of Triangles, is the ſide of like Triangles and proportional.



13. Through any three points given, as A, B, C not being in a ſtraight line, to deſcribe the circumference of a Circle.



From the Centers A and B at above half the diſtance of the given points A and B make the interſections D and E, and draw the ſtraight line D E. Again, at above half the diſtance B C, on the Centres B and C make the interſections

tesections F and G, and draw the straight G cutting the Line D E in H: Lastly, setting ne foot of the Compasses in H, with the o-ner extended to A or B, describe the circum-erence of a Circle, which shall pass through ne three points given, A, B, C.

14. The Diameter of a Circle being given to nd the circumference. Say,

As 7 is to 22, or as 1 is to 3,1416, so is the Diameter to the Circumference.

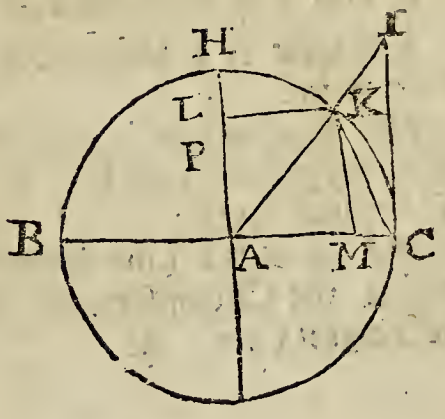
15. The circumference being given, to find he Diameter. Say

As 22 is to 7, or as 1 is to 0,3183, so is he Circumference to the Diameter.

16. *Of the Circle.*

The $\frac{1}{360}$ part of the Circumference of a Circle is called a degree, each of which are a-gain subdivi-ded into six-ty equal parts called minutes, each of which again are ima-gined to be di-vided into sixty equal parts, called seconds, *&c.* to tenths.

A Semicircle



therefore is an Arch of 180 deg. And a Quadrant 90 deg. The measure of an Angle is the Arch of a Circle described on the angular point intercepted between the sides sufficiently produced: so the measure of the right Angle is always 90 deg. And that Angle which contains less than 90 deg. is called an acute Angle, but that which contains more, obtuse.

The Complement of an Arch or Angle is so much as it wants of being compleatly 90 deg. But the Complement to 180 deg. is so much as it wants of 180 deg. which is found by substraction.

The Proportion which the Arches, (being the measures of Angles) have to the sides of a Tri. cannot be certainly known, unless by a comparing of Arches with their terminating straight lines; as *Chords*, *Sines*, *Tangents*, *Semitangents*, *Secants*, and *Versed Sines*.

A *Chord* is a right Line subtending an Arch.

A *Sine* is $\frac{1}{2}$ the Chord of the double Arch.

A *Tangent* is a Line touching the Circle in some point.

The *Semitangent* is not half the *Tangent* of an Arch, as some take it to be, but is the *Tangent* of the half Arch.

The *Secant* is a Line drawn from the Centre cutting the Circumference, and is extended to the *Tangent* Line. As

Let

Let K C be an Arch of 45 deg. then

C is the Chord.
M is the Right Sine.
A = L K the Cosine.
C is the Versed Sine. } of 45 deg.
I the Tangent.
I the Cotangent.
I the Secant.
P the Semitangent.

A K = A C = H A = B A = C I the Radius or Semidiameter. Note that the Secant of 60 deg. is equal to the double Radius.

Such proportion as the Circumference of one Circle has to another, such proportion have their degrees, Semidiameters, Sines, *&c.* of like Arches one to the other, and the contrary.

The words Cosine, or Cotangent of an Arch signifie the Sine or Tangent of the Complement of that Arch.

The Sine or Tangent, *&c.* of an Arch greater than a Quadrant, or 90 deg. is the Sine or Tangent of that Arches Compl. to 180 deg.

The Cosine or Cotangent of an Arch greater than a Quadrant, is the Sine or Tangent of the excess of that Arch above a Quadrant, or 90 deg.

Assigning the Radius A C to be a Unite with Cyphers at pleasure, to express the quantities of these respective Lines, in relation to the Arches to which they belong, is to make a Table of

natural

natural Sines, Tangents and Secants, *&c.*

Here I cannot pass without letting the world participate somewhat of the pleasure I have had in contemplating the ancient methods, and how gradually to this time they have been with great labour improved. The Ancients used the natural Chords, the circumference of the Circle being divided into 360 parts, and the Diameter into 120, with each of these subdivided into 60, the sexagenary division being the most convenient then known, and in these they estimated their Chords, a Table whereof you may see in 1 *Ptolemy Almag.* These I say were the only Tables in use, till about the year of our Lord 1430, *Regiomontanus* keeping the same division of the Circumference, divided the Diameter into 20000 equal parts, computing in these the Chords of half arches which he called Sines.

This is the first Decimal Division we find, and makes me believe it was that President that led us to our *Decimal Arith.* But tho *Regiom.* were the first introducer of the Decimal Division of the *Radius*, or whole Sine, yet it was the Saracens or Arabs that first formed and used the Sines instead of Chords, we having from them about the same time the nine useful Characters, which we call Digital Numbers, and their Uses.

Afterwards to these Tables of Sines, *Bressius* added the Table of Natural Tangents, which he

he called Adſcripts: and others, as *Vieta*, called them Proſines. After which *George Joachimus Rheticus* adds the Table of Natural Secants, which he called Hypothenuſas, or Tranſſinuoſas, all which were uſed with a great deal of labour of common Multiplication and Diviſion, till *Nicholaus Raymarus Dithmarſus* by an Art he called *Proſthapheriſis*, ſomewhat eaſed the work: this was improved by *Maginus*'s Tables, whereof you may ſee in his *Primum Mobile*: Yet Calculation remained very troubleſome, and few could endure the burthen of it, which indeed was one reaſon of theſe profitable aud otherwiſe delightful Studies lying dormant, and ſo few to meddle with them.

But at length, about the Year 1616, happy *Nepair*, Baron of *Merchiſton*, amongſt other his curious ways of facile computation, as his Bones, *&c.* hit on thoſe divine numbers the Logarithms, which were perfected by Laborious *Briggs*, to ſo great a degree, that I may boldly ſay, there never was any thing both invented, and ſo perfected in the like ſpace of time.

Logarithms are ſuch as being ſubſtituted in the place of proportional Numbers do retain an equal Difference.

The old way of making them was very laborious, by many extractions of Roots,

The beſt way yet known is thus,

Firſt, put for the Logarithm of 1, a Cypher; for 10, a Unite, with Cyphers at pleaſure;

ſure, for 100, the 2 with as many Cyphers: for 1000, the 3 with juſt ſo many Cyphers: for 10000, the 4 with Cyphers, *&c.*

Then find the difference between ſome two Logarithms above 1000, that differ by Unity thus; Multiply the two Numbers together, and that product multiply again by 434294481903 25183896, which laſt product divided by the Arith. Mean between both numbers, the Quotient is the difference required.

As to find the difference between the Logarithm of 1000 and 1001, their product is 1001000, which multiplied by 4343, makes 4347243, which being divided by 1000,5 (which is the half ſum of 1000 and 1001) the Quotient 434 is the difference of the Logarithm 1000 and 1001. Now if to the Logarithm of 1000, *viz.* 3,000000 you add 434 the ſum 3,000434 is the true Logarithm of 1001.

But if you would make your Tables to more than 6 places, it is neceſſary you begin to find the difference of the Logarithm, not of two numbers above 1000, but above 10000.

Having thus found the difference of any two Logarithms difference by Unity, and conſequently ſome of the Logarithms by dividing the difference found, by the Arith. mean between any two numbers difference by Unity, you ſhall have the difference of the Logarithms of thoſe two numbers: Thus, to find the difference between the Logarithm of 150 and

151

151, divide 434 the difference of the Logarithm of 1000 and 1001 by 150,5 the Arith. Mean between 150 and 151 the Quotient 288 is the difference required.

Having by this means made a few of the prime Logarithms, the reſt are made there from by Addition and Subſtraction, and having made the Canon upward above 1000 to 10000 by conſequence its made for all inferior Numbers. The Sines and Tangents in this Book are the Logarithms of the Natural Sines and Tangents before deſcribed.

To take out of the Tables the Logarithm of any number under four places.

Each Logarithm conſiſts of two parts, the Body of the Logarithm (as one may call it) and the Index, of which the firſt only are in the Tables, and conſiſt of 6 places. The Index or Characteriſtick is put to the left-hand of the Tabular Number after it's tâken out, and ſeparated from the reſt by a Comma.

The uſe of the Index is to ſhew of how many Figures or Places from Unity, the natural number ſignified thereby doth conſiſt; the other ſix ſhew more exactly the juſt number ſignified by the Logarithm. To take out of the Tables any number under 100, look in the firſt page of the Table, and you'll find every Logarithm plainly ſet down right againſt its proper number. Thus the Logarithm of 1 is 000000; of 2 is 301030, &c.

But

But if you be to find the Logarithm of any number above 100 consisting of three places, but under four, look along the Margin of the Table under N, page after page till you find your number, then in the next Column to the right hand, *viz.* in that which is marked (0) on the top you have the Logarithm.

Thus the Logarithm of

102 is 008600
110 is 041393, *&c.*

To which annex their proper Indices thus, if the integer place of the Natural, or absolute Number be under 10, annex 0 to the last hand of the 6 numbers thus found in the Table, separating it with a Comma, if the integer places of the natural number be above 10, and under 100, put 1 for its Index, if above 100, and under 1000 give it 2 for the Index; but if above 1000, yet under 10000 its Index must be 3; and all numbers from 10000 to 100000 have for their Char. 4, *&c.* the Index being always a Unite less than the number of integer places the natural number consists of: so the Logarithm of 2 with its Index is 0,301030, the Logarithm of 102 with its proper Index is 2,008600, and the Logarithm of 110 is 2,041393.

To find the Logarithm of any number consisting of between four and five places.

Note,

Note, that the Table is divided into 10 large Columsn, 5 on the right hand page, and 5 on the left: alſo each of the numbers in the Margin are ſuppoſed to be increaſed by 10; and the figures 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, which are ſet at the head of each Column, are to be put to the figures in the Margin, to make them a place more; ſo that in looking the Logarithm of any number above four places, whether, it be whole number, mixt, or Decimal, firſt look for the three firſt figures down along the left Column under N, page after page till you find it, then look right againſt it Column after Column till you come under your fourth figure, which you muſt look on the top of your page, then in the common Angle is the true Logarithm of your number, annexing the proper Index as directed. But here note, that the Index is always according to the integer places, or places of Integers, if any, and not at all according to the Decimal Parts, But if the natural number be wholly Decimal Fractions, then put its Index according to its moſt left hand Figures place from the place of Unites.

Thus the Logarithms of

2753 is 3,439806
546.8 is 2,737829
30.54 is 1,484869
4621 is 0,664736

0.3105

0 3105 is 1,492861
0.003105 is 3,492062.

To find the Logarithm of any number between 10000 and 100000, you must first seek the Logarithm of the four first places as before directed, taking notice of the difference that stands in the most right hand Column under D, with this difference enter the Table of proportional parts, which are at the end of the Logarithm, and there directly against that number, and under your fifth Figure you have a proportional number, which being added to the Logarithm of the first four places, makes the complete Logarithm of your number. If the Logarithm of 35786 be sought, first seek the Logarithm of 3578, which will be 553649, and the common difference under D 121, with this difference enter the Table of Parts proportional, and find 121 in the first Column under D, and then against that number, and under 6 the last figure of the last place of the number 35786, found at the head in the seventh Column you will find 72, which added to 553649, makes 553721, to which prefixing its Index 4, you have 4, 553721 the Logarithm of 35786; but if the number had been 3578.6 the Logarithm had been 3,553721, if 357.86 the Logarithm had been 2,553721; if the natural number had been 35 786, the Logarithm had been 1,553721, and if 3.5786, the

Logarithm,

Logarithm 0,553721, *&c.* so that the Logarithm is the same, but the Index alters according to the place of the first, greatest, or most left hand figure.

To find the number answering to any Logarithm given; omitting the Index, seek the other six figures in the Table of Logarithms, and if you cannot find them all exact, take the neareſt, then are the numbers in the Margin with that other figure over-head the natural or absolute number.

The Logarithm 3, 544821 omitting the Index 3, I find 544821 to answer 3506, and the Index shews there are to be four integer places, therefore they are all integers: so the Logarithm 1,544821 looked in the Table would give 3506, that is, 35.06 and 1,544821, 0,3506 all Decimal Parts.

If the Logarithm cannot be exactly found, and yet you desire to have the natural number to five places, first find the number to 4 places as before noting the common difference under D on the right side, and taking the difference betwixt the Logarithm given, and the next less Logarithm found in the Table, then seeking the common difference in the Table of proportional parts, in that Line find out the difference of the Logarithm, and over-head you have the fifth Figure.

To exemplifie in the Logarithm 2, 543612, the Logarithm next less is 543571 answering to

to 3496, the common difference is 124, the difference of the Logarithm 1541, which in the Table of proportional parts against 124 gives 3, so that the natural number is 34963, and because the Index is 2, is 349.63.

To find the Sine or Tangent of any Degree and Min.

If the Degree be less than 45 deg. look it on the head of the Table, and the minutes down the left Column under M: but if the Degree be above 45, look it at the bottom or foot of the Table, and look the minutes upward in the Right-Hand Column, and in the Column distinguish'd by the Title of Sine, or Tangent, or Cosine or Cotangent (at the bottom or top according as the Degree is) right against the min. you have the Sine, Tangent, or Cosine sought for.

Suppose you were to find the Logarithm, Sine or Tangent of 32 deg. 12' look for 32 deg. at the head of the Table, and down the left hand Column under M for 12', then right against 12 minutes under the word *Sine* at the head of the Table you shall find 9,726626 which is the Logarithm Sine of 32 deg. 12', and against 12 under (*Tang.*) you have 9.799157, the Logarithm Tangent of 32 deg. 12'.

Suppose you were to find the Sine or Tangent

gent of 37 deg. 47', look 37 deg. at the head of the Table, and upon the Right-hand Page, (becauſe the minutes exceed 30) in the Column under M, you muſt look for 47' and againſt 47' and under (*Sine*) at the head of the Table you will find 9,787232 the Sine of 37 deg. 47' and againſt 47', and under (*Tan.*) you'll find 9,889421 the Tang. of 37 deg. 47'.

Admit you were to find the *Sine* or *Tangent* of 64 deg. 15'. Turn to 64 deg. at the bottom of the Table, and upon the Right Hand Page in the Column over M look upwards for 15, againſt 15 and over (*Sine*) at the foot of the Table, you'll find 9,954579 the Sine of 64 deg. 15', and againſt 15', over (*Tang.*) you'll find 10,316644 the *Tang.* of 64 deg. 15', alſo againſt 15' over (*Coſine*) you'll find 9,637935 the Sine Compl. or Coſine of 64 deg. 15'.

Suppoſe you were to find the Sine or Tangent of 78 deg. 55 min. Turn to the 78 deg. at the bottom of the Tables, and upon the Left Hand Page (becauſe the min. exceeds 30) over M look for 55 min. againſt which, and over (*Sine*) you'll find the Sine of 78 deg. 55 min. to be 9,991823, and the Tangent in the ſame Line over *Tang.* to be 10,707987, and the Cotang. in the ſame line over *Cotang.* to be 9,292013.

To find the Sine or Tang, of any number of Degrees and Minutes, exceeding 90, ſubſtract them

them from 180 deg. and look the Sine, Cosine or Tang. of the reſt, as above directed, as to find the Tang. of 153 deg. 7 min. its compl. to 180 deg. is 26 deg. 53 min. which looked in the Table gives under the Title *Tang.* 9,704976 for the Tang. of 153 deg. 7 min.

To find the Sine or Tangent of any Degrees and Minutes above 180, but under 270, ſubſtract 180 there-from, and look the Sine or Tangent of that remain'd; as

To find the Sine or Tangent of any number of Seconds under a minute. From the Sine or Tang. of 1 min. ſubſtract the Logarithm of 60, and to the Remainder add the Logarithm of the number of Seconds given.

Admit the Sine of 14 min. were required.

The Sine of 1 min. is	6,463726
The Logarithm of 60 is	1,778151
The Remainder	4,685575
The Log. of 14	1,146128
The Sine of 14 min.	5,831703

A Sine or Tang. being given, to find the Degrees or Minutes anſwering thereto, if it be Sine leſs than 9,8494, or a Tang. leſs than 10,0000, then its a Sine or Tangent leſs than 45 deg. and is to be ſought in thoſe Columns noted with the words (*Sine Tang.*) on the head

head of the Table. But if the Sine or Tang. exceed theſe reſpective Numbers, then the Degrees anſwering thereto are more than 45 deg. and are to be found in thoſe Columns marked (*Sine*, *Tang.* at the bottom: as

Let it be required to find the Arch anſwering to this Sine 9,645632; this being leſs than 9,8494, I run over the Columns of Sines, that have (*Sine*) writ on the head, and under 26 deg. and againſt 15 min. I find the neareſt number to my given Sine.

Admit again I were to find the Degree and Min. correſponding to this Tang. 11,276481, this being greater than 10,000000, I look over the Columns of Tang. marked (*Tang.*) at the bottom of the Table and over 86 deg. and againſt 58 min. I find the neareſt, therefore the neareſt Degree and Min. anſwering, are 86 deg. 58 min.

To multiply one number by another; by the Log.

Add the Logarithms of the Numbers, and the Sum is the Log. of the Product.

To divide one number by another, is to ſubſtract the Logarithm of the Diviſor from the Logarithm of the Dividend.

Three numbers being given to find a fourth proportional by the Log.

Add the Logarithm of the ſecond and third numbers together; and from that Sum ſubſtract the Logarithm of the firſt, then is the remainder

the

the Logarithm of the fourth Number ſought.

To extract the Square Root of a Number: Halve the Logarithm of the Number, or divide it by 2, and the quot. is the Log. of the Root. But to extract the Cube Root, divide the Logarithm of the given number by 3, and the quot. is the Log. of the Root.

Of Triangles in general.

1. A Triangle is a Figure comprehended of three ſides: and is either Plain or Sphærical.

2. A plain Triangle is that which is deſcribed on a plain Surface, and if its three ſides be right Lines, it's called a right lined plain Triangle; and that is again either right angled, or oblique angled; and the oblique, is either obtuſe or acute.

3. Any one ſide of a right-lined plain Triangle is leſs than the ſum, and greater than the difference of the other two ſides.

4. All the three Angles of every right lined plain Trian. is equal to 180 deg. or a Semicircle: therefore if two Angles of a Triangle be known, the third is alſo known, being only the Compl. of their ſum to 180 deg. Alſo if one Angle be known, the ſum of the other 2 is known only by ſubſtracting from 180 deg.

5. Any one ſide of a right lined plain Triangle being continued, the exterior Angle is equal to the two interiour Angles oppoſite.

6. A

6. A plain right angled Triangle hath one ght Angle which is equal to both its other ngles, and therefore are neceſſarily the Com- ements one of the other, ſo that the one be- g known, the other is alſo known.

7. In a right angled plain Triangle, the m of the Squares of the Sides containing the ght Angle is equal to the Square of the Hypo- enuſal.

The Doctrine of plain Triangles, Trigonometria, the Doctrine of Triangles teaches the man- r of computing the Sides and Angles of Tri- gles, from certain *data.*

In every Triangle are ſix parts; three Sides, d three Angles.

In a right angled Triangle are given two be- des the right Angle, and in an oblique Tri- gle are given three of theſe parts to find a urth.

But note, that the 3 Angles are not ſufficient the Sides, they give no proportion of the des. Any one of the Sides of a right an- ed plain Triangle may be made the *Radius* of Circle, and then the other Sides will be Sines, angents, or Secants of Angles, and what pro- ortion the Side put, as *Radius* hath to the *adius*, the ſame hath the other Sides, to the ines, Tangents, or Secants by them repreſent- d. From hence are deduced the two firſt ollowing Axioms.

Axioms for the ſolution of all plain right-lined Triangles.

1. In any plain Triangles the Sides are directly proportional to the Sines of their oppoſite Angles. *And the contrary.*

2. In the right-angled Triangles, as one Leg is to the other: ſo is the *Radius* to the Tangent of the Angle oppoſite to this laſt Leg. *And the contrary.*

3. In any plain right-lined Triangle, as the ſum of any two ſides is to their difference, ſo is the Tangent of the half ſum of their oppoſite Angles, to the Tangent of their half difference, and the ſum of the $\frac{1}{2}$ ſum and $\frac{1}{2}$ difference is the greater: therefore if two Sides and the Angle included be given, the reſt from hence will be known.

4. As the Baſe is to the Sum of the other two Sides; ſo is the difference of thoſe Sides, to the difference of the Segments of the Baſe.

Note that in ſtating the Caſes of Triangles, if a Side be ſought, you put the *Radius*, or an Angle firſt: but if an Angle be required, put a ſide firſt.

Theſe four Prop. reſolve all plain Triangles.

Of

Of the World.

ll the glorious ſpangled Canopy of Stars we with the Earth, and whatever elſe is con-ed therein is called the *world*, which tho to eeming ſo vaſtly extenſive and great, is but ry ſmall part of the Univerſe.

his Canopy, or admirable Concameration t reſpecting the Earth, which is a part, n we call it World) is called Heaven.

Of the Heaven and Stars.

he Stars are of two kinds, Fix'd and Mo-e.

he Fix'd always keep at the ſame diſtance poſition one from the other, and are far-known from the movable by their twink-

ne Movable are either ſuch as move regu-, and according to a known order, and alled Planets, or irregular, whoſe way and of moving nothing can be ſaid of, till the is ſeen: theſe are called Comets and Bla-Stars.

ne fix'd Stars being many thouſands are for action's ſake nominated by Parcels, or Con-tions, to which are given the names of

Men, Birds, Beasts, or somewhat else, as pleased the Ancients. Of these Constellatio there are about 60, the Stars in them be some bigger, and some lesser, according t Rates or Magnitude, those of the first Rate ing the very biggest of all we see; the seco are of the size of those 7 well-known ones *Charles's Wain*; the third of that of the P Star. Within this Sphere of Fix'd Stars contained the Planets, Earth, and Sun, the S being fix'd, and as the Center, round whi the Planets move.

These Planets are either Primary, whi move about the Sun, as their common Cent the nearer swifter, and the remoter slow according to their distances from him: Or S cundary, which move about the Primary their proper Centre, as our Moon about t Earth, and both together about the Sun.

The Primary Planets are six.

♄ *Saturn*, the farthest from the Sun.

♃ *Jupiter*, the next.

♂ *Mars* moves within the Orb of *piter*.

♂ The Earth within that of ♀.

♀ *Venus* is the next to the Earth.

☿ *Mercury* is the innermost next the S So that the Earth is between the Orbs of and ♀.

Tho the Earths annual Orb be very lar compared with its own Diameter, yet if co par

red with the vaſt diſtance at which the xed Stars are placed without it, the Angle it tends is hardly ſenſible. So that in what part ever of her Orb the Earth is, ſhe is never-eleſs to appearance, and the ſharpeſt ſcrutiny ſenſe, in the Centre of the Starry Heaven; and nes produced from her Centre to each Star, point in Heaven, or to all the points in any rcle in the Heavens, ſhall deſign the Star-oint, or Circle on the Earth's ſurface.

of the Body or Maſs of Earth and Water.

That it's a Globe, and has a property of at-racting all it's parts, or it's parts a tendency, alled weight, towards it's middle point or entre, and that upward and downward are erms only reſpecting the Center, or ſaid middle oint of the Earth, I ſhall not need to inſiſt pon, they being common, and well known otions already apprehended by moſt people.

This Globe of Earth and Water has two oints directly oppoſite the one to the other, hat conſtantly inſpect the ſame parts or points of the Heavens, which points are called Poles, s are alſo thoſe points in the Heavens in-ſpected.

A line paſſing through the body of this Globe from

from one Pole to the other, and alſo paſſing t
Centrer, is called the *Axis.*

Imagine a Circle to girt this Globe of Ea
and Water round in the middle between t
two Poles, ſo that the plain of the Circle m
be at right Angles to the *Axis*; this Circle
called the Equinoctial Circle or Line, and
being the principal Line of uſe among Seame
they often omit the word Equinoctial, callin
it *the Line.* A Circle right over this in th
Heavens is called by the ſame name.

Again imagine Circles to paſs from one Po
to the other through as many degrees or poin
of the Equinoctial, as you pleaſe, theſe Circl
are called *Meridians.*

The Circle you ſee in a clear day where th
Sky and Sea ſeems to meet all round is calle
the viſible *Horizon*, parallel to which at the di
ſtance of the Earth's Semidiameter is the *tru
Horizon.*

The point in the Heavens directly over you
head in all places, is called the Zenith, and th
point under the feet is called the *Nadir*, and ar
each of them 90 degrees from the Horizon.

Now again imagine Circles to be deſcribed
in the Heavens round the Globe, all meeting
in the Zenith and Nadir, as the Meridians do in
the Poles, and to cut the Horizon at right An-
gles as the Meridians do the Equinoctial.

Theſe Circles are called *Azimuth Circles.*

And if there be imagined Parallels to the Ho-
rizon

zon upwards towards the Zenith, they are call-
Almucanters, or Circles of Altitude.
Thoſe that inhabit under the Equinoctial are
d to have a *right Sphere*; thoſe under either
ole a *Parallel Sphere*; but thoſe in any other
rt an *Oblique Sphere*.

f the Motions attributed to the Sun.

The Sun ſeems to have a twofold motion,
e one from Eaſt to Weſt, by which he makes
e days and nights, and is, tho ſeemingly, a
otion in the Sun, only the turning of this
lobe of Earth and Water on its own *Axis* from
Veſt to Eaſt in twenty four hours.
The other is of the Sun to Weſt from Eaſt,
iite round within the Orb of the Fix'd Stars
om Conſtellation to Conſtellation till in about
$365\frac{1}{4}$ days he comes to the ſame place or Conſtel-
tion again, and the tract or way he deſcribes a-
ongſt the fix'd Stars in this paſſage, is called
he Ecliptick, which is divided into twelve e-
ual parts, called Signs, and are named thus,

♈ *Aries*, ♉ *Taurus*, ♊ *Gemini*, ♋ *Cancer*, ♌
eo, ♍ *Virgo*, ♎ *Libra*, ♏ *Scorpio*, ♐ *Sagit-*
arius, ♑ *Capricornus*, ♒ *Aquarius*, ♓ *Piſces*.

This motion alſo, tho attributed to the Su is really a motion of the Earth round the Su making Summer and Winter, Increaſe and D creaſe of Declination, and length of days wi differing times and places of Riſing and Se ting.

The points where the Equinoctial and Eclip ick cut one the other are called the Equinoct al Points.

The diſtance of the Sun or any Srar from th Equinoctial, either North or South, or th Arch of a Meridian between the Sun or Sta and the Equator is called its Declination.

When by the turning of the earth on it's *Axi* the Eaſt Part of the Horizon is brought to th Sun or any Star, the ſun or ſtar is ſaid to riſe and when the Weſt Part of the Horizon i brought to the ſun or ſtar, it's ſaid to ſet.

The point or degree of the Equinoctial tha comes to the Meridian, together with the ſun or any ſtar being numbred from the Equinoctia Point ♈ is called it's *Right Aſcenſion.*

The degree of the Equinoctial that riſeth with the ſun or ſtar in an oblique ſphere is called its oblique Aſcenſion, and the degree that ſets with it the oblique Deſcenſion.

The diſtance of the ſun or any ſtars riſing from the Eaſt, or ſetting from the Weſt, that is, the Arch of the Horizon between the Riſing Star and the Eaſt, or ſetting ſtar and the Weſt Point is called its *Amplitude.*

The

The Time of the Suns rising or setting before after six of the clock, is called its *Difference Ascension.*

The Arch of the Horizon between the Meian, and an Azimuth Circle passing through Center of the sun, or any star, is called the *imuth.*

Altitude is the Angle between the Horizon d Visual Ray, or Line, passing from the eye the Center of the sun or star observed.

Of the Moons Motions.

To the Moon also is attributed a twofold moon, the first from East to West in 24 hours, minutes nearly, whereby she seems to rise, lminate and set, being likewise as in the sun d stars only an effect of the Earths dayly moon on its *Axis* : for tho the diurnal motion of e Earth be performed in 24 hours neareſt, yet cause the moon every day, by her own motion oves Eastward (as after will be shewed) about 13 degrees each day, the Meridian doth ot come to her, or she to it, till 13 degrees, or minutes of time after its return to the sun, or minutes of time after its return to the same oint of the Heavens.

The other motion is from West to East round out the Earth contrary to the first, whereby e appears in all her phases, and makes all her

Aſpects with the ſun and ſtars, as Horned, Hal
ed, Gibbous, New, now applying to this ſta
then obſcuring that *&c.* And in this her prop
motion ſhe is 27 deg. 8 hours, paſſing from ar
firſt ſtar or point of the Ecliptick, till ſ
comes to it again. But from one Conjunctic
with the ſun to another, ſhe ſpends 29 degree
12 hours; for tho in 27 deg. 8 hours ſhe re
turn to the ſame point of the Ecliptick, ſh
doth not find the ſun in the point ſhe left him
for the Earth or ſun moving every day abou
one degree towards the Eaſt, is moved ſo fa
from the place where the Moon left him, as tha
ſhe cannot over-take the ſun to come in Conjun
ction with him, until ſhe has moved 2 deg. 4
hours, 44 m. more, and this is the true cauſe why
there's 29 deg. 12 hours, 44 min. betweer
New and New, when as in 27 deg. 8 hours
ſhe compleats her revolution from any fix'd
point of the Heaven to the ſame again.

But the moſt People loving round numbers,
have for a long time uſed to allow 30 days be-
tween one Conjunction and another, which
tho it be 11 hours, 16 min. too much; yet for
as much as its a cuſtom amongſt them, I ſhall
here not reform but explicate.

Now by dividing 360 by 30, its plain that
ſhe departs from the ſun each day 12 degrees,
or 48 minutes of time, which is $\frac{4}{5}$ of an hour,
ſo that ſhe will come to the Meridian $\frac{4}{5}$ of an

hour

ır every day later than the day before, and many days old as she is, so many times $\frac{4}{5}$ an hour, or $\frac{4}{5}$ of so many hours will she ne to the Meridian after the sun.

For want of a fitter Instrument to observe s separation of the Moon from the sun at sea, y have applyed this motion of the Moon to Compass, making it an Horizontal Motion, iding the Compass Card into hours and rters, a division proper only to the Equi-ctial, this they use for the estimating time, also for computing the Tydes, for both which very unfit, and no ways to be allowed of, es near the Pole where the Equinoctial and rizon do almost coincide.

A

A Table of the Latitudes and Longitudes of th principal Ports, Harbours, Head-Lands an Iſlands in the World. Their Longitud being reckoned from the *Lizard*.

Coaſt of *Greenland* and *Nova Zembla*.

Places Names.	Latitude North.	Long. Eaſt.
	de.g mi.	d. m
Hacluits Head-Land	79 35N	17 5
Fair Foreland	79 30N	15 45
Point look out	77 30N	22 2
Hope Iſland	76 56N	31 45
Cherry Iſland	75 20N	30 30
Ice Point	77 10N	71 30
Cape Naſſaw	76 30N	70 00
Admiralties Iſland	75 10N	68 20
Burroughs Strait	66 30N	68 30

Coaſt

Coaſt of *Lapland* and *Norway*.

Places Names.	Latitud. North		Long. Eaſt.	
	deg.	m.	d.	m.
Cape Candenoſe	68	40N	48	10
Bergen	61	00N	11	10
Archangel	65	30	45	20
Wardſh	70	50	33	10
Kildivia Iſle	69	50	36	00
North Cape	71	38	27	30
Naze of Norway.	58	11	11	30

Coaſts

Coasts in the *Sound.*

Places Names.	Latit. North.		Longit. East	
	d.	m.	deg.	mi.
Dantzick	54	23	24	38
Stetin.	53	26	20	00
Stockholm	59	20	23	43
Gotland Isle.	58	20	22	45
Elsenore	56	40	17	47
Copen-Haven	55	43	17	45
Gottenberg	58	10	15	17
The Scaw	57	37	5	30
Coningsberg	55	08	26	00

Islands

Iſlands about the Coaſts of *Scotland*.

Places Names.	Latit. North		Longit. Eaſt.	
	d.	m.	deg.	mi.
Shotland	60	22	03	30
Iſles of Orkney	58	50	02	20
Fair Iſlands	61	43	00	10W
Lewis Iſland	58	30	01	30W
Kilda Iſland	58	02	02	10W
Buſs Iſland	59	10	12	40W

Coaſt of *Iſland*.

Places Names.	Latit. North		Longit. Eaſt.	
	d.	m	d.	m.
Longeneſs	58	04	08	50W
Merchants Foreland	63	36	12	50W

Coaſts

Coasts of *Holland* and *Flanders.*

Places Names.	Latit. North		Longit. East.	
	d.	m.	d.	m.
Hamburg	53	44	14	20
The Texel	53	03	11	00
Amsterdam	52	22	10	58
Roterdam	51	59	10	30
The Brill	51	55	10	08
Ostend	51	17	9	28
Dunkirk	51	06	8	55
Calice	51	00	0	05
Antwerp	51	12	10	30

Coast

Places Names.	Latit. North		Longit.	
	d.	m.	d.	m.
Buchaneſs	58	04	3	45
Tinmouth	55	12	5	10
Flambrough Head	54	10	6	8
The Sporn	53	45	6	20
London	51	30	6	00
Winterton-neſs	52	54	7	45
Orfordneſs	52	24	7	40
North-Foreland	51	36	7	35
South-Foreland	51	13	7	30
Dover	51	12	7	29
Dungeneſs	51	00	7	08
The Beach	50	43	6	46
Eaſt-Foreland of the Wight	50	32	4	56
Donoſe	50	26	4	36
The Needles	50	33	4	15
Portland	50	28	3	25
The Start	50	8	1	53
The Lizard	50	8	0	00
The Southermoſt of all the Iſles and Rocks of Sille	50	9	1	10W
Londeys Iſle	51	28	1	20
Davids Head	52	05	0	35 E
Briſtol	51	18	3	30
The South Point of S. Maries, one of the Silly Iſles	50	15	0	52W
The middle of Angle, or S. Agnes one of the Iſles of Silly, on which is the Light-houſe.	50	15	1	02W
* *Liverpool*	53	20	3	32 E

In the Irish Seas.

Places Names.	Latit. North.		Longit. East.	
	d.	m.	d.	m.
Holy Head.	53	33	1	36
The Calf of Man	54	10	1	20
The most Northerly Point of the Isle of Man, called Point Aire.	54	34	1	40
Fair-Head, or Fair-Foreland	55	15	0	35W.
Blasques	52	03	3	35W.
Missen-Head	51	19	3	45W.
Cape Clear	51	03	3	00W.
Old Head	51	28	2	30W.
Black Rock	52	08	0	35W.
Dublin	53	12	0	30W.

Western

Weſtern Coaſts of *France*, *Spain* and *Portugal*.

Places Names.	Latit. North.		Longit. Eaſt.	
	d.	m.	d.	m.
Seyn Head	49	50	6	20
Cape Hage	49	55	3	35
Garnſey	49	35	3	05
Jerſey	49	30	3	30
Uſhant	48	35	0	00
S. Malos	48	28		
Breſt	48	30	0	10
Bourdeaux	45	30	4	30
Bilboa	43	34	2	40
Cape Ortegal	44	04	2	00W
Cape Finiſterre	43	06		
* *Lisbon*	38	48	3	30W
Cape Vincent	37	00	3	45W

Sea

Sea Coasts on the North-Side of the *Mediterranean* from the *Straits*-Mouth to the Head thereof.

Places Names	Latit. North		Longit. East.	
	d.	m.	d.	m.
Cape de Gata	36	35	2	47
Cape Martin	38	34	5	27
* *Marseilles*	43	20	11	30
Genoa	44	27	15	50
* *Rome, the City*	41	45	21	00
Cape Sparteventura	37	34	25	00
Cape Maria	39	40	27	00
* *Naples*	41	03	22	42
Livornia, or *Legorn*	43	18	17	45
* *Venice*	45	20	19	48
Cape Matapan	36	00	31	40
* *Salamanca*	41	12	11	45
* *Alepo*	36	06	41	15
* *Alexandria*	30	58	37	00
Antiochia	36	15	43	15
Athence	37	42	33	07
* *Barcellona*	41	26	9	00
* *Grand Cair*	29	50	38	15

Places

Places in the *Mediterranean* on the North Side.

Places Names.	Latit. North		Longit. East.		
	d.	m.	d.	m.	
* *Florence*	43	40	16	00	
* *Parma*	44	51	17	30	
* *Pisa*	43	28	18	00	
Tunis	35	18	17	37	
Cape Tres Forcas	35	28	2	07	
Tangier	35	25	0	54	E

Ilands

Islands in the *Straits*.

Places Names.	Latit. North		Longit. East.	
	d.	mo	d.	m.
* *Palermo, on the Isle Sicily.*	38	1	21	10
*Porton Majorca	39	35	9	15
* *Rhodes.*	36	00	35	50
Minorca	39	56	10	50
Cape Napoli in Sardinia.	39	10	15	31
Malta	35	45	22	40
Messina	37	20	20	55
Corfu	38	54	27	50
Cephalonia	37	57	28	30
Zant	36	42	28	40
Cape Spudea in Candia.	34	50	32	05
Candia City.	34	40	31	50
West End of Cyprus	33	27	39	10
East End of Cyprus	33	53	42	35

The

The Difference of Longitude between the *Lizard* and *London* is between 5 deg. 37 min. and 5 deg. 44 min.

Breſt is from *Paris* 7 deg. and from *London* 30 deg. 40 min. and from the *Lizard*, allowing the diſtance of the *Lizard* from *London* to be 5 deg. 40 min. juſt 1 deg. 00 min, but if we make the diſtance between *London* and the *Lizard* to be 6 deg. then the difference is 1 deg. 20 min.

Ferraria is more Eaſterly than *Bononia* by 15 min. 4 ſec. And *Ravenna* is more Eaſterly than *Bononia* by 42 deg. 26 ſec. *Mantua* is more Weſterly than *Bononia* by 23 deg. 27 ſec.

The true difference of Longitude between *Palma* and the *Lizard* is 12 deg. 5 min.

An Advertiſement.

THE New World of Words. Or a General Engliſh Dictionary, Containing the Proper Significations and Etymologies of all Words derived from other Languages, *viz. Hebrew, Arabick, Syriack, Greek, Latin, Italian, French, Spaniſh, Britiſh, Dutch, Saxon,* &c, uſeful for the Adornment of our Engliſh Tongue. Together with the Definitions of all thoſe Terms that conduce to the underſtanding of any of the Arts or Sciences, *viz.* Theology, Philoſophy, Logick, Rhetorick, Grammar, Ethicks, Law, Magick, Phyſick, Chyrurgery, Anatomy, Chymiſtry, Botanicks, Arithmetick, Geometry, Aſtronomy, Aſtrology, Chyromancy, Phyſiognomy, Navigation, Fortification, Dialling, Surveying, Muſick, Perſpective, Architecture, Heraldry, Staticks, Merchandiſe, Jewelling, Painting, Graving, Husbandry, Horſemanſhip, Hawking, Hunting, Fiſhing, Carving, *&c.* To which are added, The Significations of Proper Names, derived from the Ancient or Modern Tongues; as alſo the very ſum of all Mythology and Ancient Hiſtory, deduced from the Names of Perſons eminent in either; and likewiſe the Geographical Deſcriptions of the chief Countries and Cities in the World; eſpecially of theſe three Nations, wherein their chiefeſt Antiquities, Battels, and other moſt memorable Paſſages are mentioned: not omitting all other Subjects that are uſeful, and appertain to Advance our *Engliſh* Language. The Fourth Edition.

Sold by *Obadiah Blagrave* at the *Bear* in S. *Paul's* Church-Yard, near the Little North-door.

A *Table* of *Logarithms*, from Unity to 10000, by which all the Parts annexed, the Logarithms of all Numbers under 100000 may easily be supplied.

N	Log.	N	Log.	N	Log.
1	000000	34	531479	67	826075
2	301030	35	544068	68	832509
3	477121	36	556302	69	838849
4	602060	37	568202	70	845098
5	698970	38	579784	71	851258
6	778151	39	591065	72	857332
7	845098	40	602060	73	863323
8	903090	41	612784	74	869232
9	954242	42	623249	75	875061
10	000000	43	633468	76	880814
11	041393	44	643453	77	886491
12	079181	45	653212	78	892095
13	113943	46	662758	79	897627
14	146128	47	672098	80	903090
15	176091	48	681241	81	908485
16	204120	49	690196	82	913814
17	230449	50	698970	83	919078
18	255272	51	707570	84	924279
19	278754	52	716003	85	929419
20	301030	53	724276	86	934498
21	322219	54	732394	87	939519
22	342423	55	740363	88	944483
23	361728	56	748188	89	949390
24	380211	57	755875	90	954242
25	397940	58	763428	91	959041
26	414973	59	770852	92	963788
27	431364	60	778151	93	968483
28	447158	61	785330	94	973128
29	462398	62	792392	95	977724
30	477121	63	799341	96	982271
31	491362	64	806180	97	986772
32	505150	65	812913	98	991226
33	518514	66	819544	99	995635

N	0	1	2	3	4
100	000000	000434	000868	001301	00173
101	004321	004751	005181	005609	00603
102	008600	009026	009451	009876	01030
103	012837	013259	013679	014100	01452
104	017033	017451	017868	018284	01870
105	021189	021603	022016	022428	02284
106	025306	025715	026124	026533	02694
107	029384	029789	030195	030600	03100
108	033424	033826	034227	034628	03502
109	037426	037825	038223	038620	03901
110	041393	041787	042182	042575	04296
111	045323	045714	046105	046495	04688
112	049218	049605	049993	050380	05076
113	053078	053463	053846	054230	05461
114	056905	057286	057666	058046	05842
115	060698	061075	061452	061829	06220
116	064458	064832	065206	065580	06595
117	068186	068557	068928	069298	06966
118	071882	072250	072617	072985	07335
119	075547	075912	076276	076640	07700
120	079181	079543	079904	080266	08062
121	082785	083144	083503	083861	08421
122	086360	086716	087071	087426	08778
123	089905	090258	090611	090963	09131
124	093422	093772	094122	094471	09482
125	096910	097257	097604	097951	09829
126	100371	100715	101059	101403	10174
127	103804	104145	104487	104828	10516
128	107210	107549	107888	108227	10856
129	110590	110926	111262	111598	11193
130	113943	114277	114611	114944	11527
131	117271	117603	117934	118265	11859
132	120574	120903	121231	121560	12188
133	123852	124178	124504	124830	12515
134	127105	127429	127752	128076	12839

5	6	7	8	9	D
2166	002598	003029	003460	003891	432
6466	006894	007321	007748	008174	428
0724	011147	011570	011993	012415	424
4940	015360	015779	016197	016615	420
9116	019532	019947	020361	020775	416
3252	023664	024075	024486	024896	411
7350	027757	028164	028571	028978	408
1408	031812	032216	032619	033021	404
5430	035830	036229	036629	037028	401
9414	039810	040207	040602	040998	397
3362	043755	044148	044540	044931	393
7275	047664	048053	048442	048830	390
1152	051538	051924	052309	052694	386
4996	055378	055760	056142	056524	383
8805	059185	059563	059942	060320	379
2582	062958	063333	063708	064083	376
6326	066698	067071	067443	067814	373
0038	070407	070776	071145	071514	370
3718	074085	074451	074816	075182	366
7368	077721	078094	078457	078819	364
0987	081347	081707	082067	082426	361
4576	084934	085291	085647	086004	357
8136	088490	088845	089198	089552	355
1667	092018	092369	092721	093071	352
5169	095518	095866	096215	096562	349
8644	098989	099335	099681	100026	347
2091	102434	102777	103119	103460	344
5510	105851	106191	106531	106870	341
8903	109241	109578	109916	110253	338
2270	112605	112940	113275	112609	336
5610	115943	116276	116608	116540	332
8926	119256	119586	119915	120245	330
2216	122543	122871	123198	123525	328
5481	125806	126131	126456	126781	325
8722	129045	129368	129690	130012	323

N	0	1	2	3	4
135	13033	130655	130977	131298	13161
136	133539	133858	134177	134496	13481
137	136721	137037	137354	137671	13798
138	139879	140194	140508	140822	14113
139	143015	143327	143639	143951	14426
140	146128	146438	146748	147058	14736
141	149219	149527	149835	150142	15044
142	152288	152594	152900	153205	15351
143	155336	155640	155943	156246	15654
144	158362	158664	158965	159266	15956
145	161368	161667	161967	162266	16256
146	164353	164650	164947	165244	16554
147	167317	167613	167908	168203	16849
148	170262	170555	170848	171141	17143
149	173186	173478	173769	174060	17435
150	176091	176381	176669	176959	17724
151	178977	179264	179552	179839	18012
152	181844	182129	182415	182699	18298
153	184691	184975	185259	185542	18582
154	187521	187803	188084	188366	18864
155	190332	190612	190892	191171	19145
156	193125	193403	193681	193959	19423
157	195900	196176	196453	196729	19700
158	198657	198932	199206	199481	19975
159	201397	201670	201943	202216	20248
160	204120	204391	204663	204934	20520
161	206826	207096	207365	207634	20790
162	209515	209783	210051	210319	21058
163	212188	212454	212720	212986	21325
164	214844	213109	215373	215638	21590
165	217484	217747	218010	218273	21853
166	220108	220370	220631	220892	22115
167	222716	222976	223236	223496	22375
168	225309	225568	225826	226084	22634
169	227887	228144	228400	228657	22891

5	6	7	8	9	D
939	132260	132580	132900	133219	321
5133	135451	135768	136086	136403	319
3303	138618	138934	139249	139564	316
1450	141763	142076	142389	142702	314
4574	144885	145196	145507	145818	311
7676	147985	148294	148603	148911	309
0756	151063	151370	151676	151982	307
3815	154119	154424	154728	155032	305
6852	157154	157457	157759	158061	303
9868	160168	160469	160769	161068	301
2863	163161	163459	163758	164055	298
5838	166134	166430	166726	167022	297
8792	169086	169380	169674	169968	295
1726	172019	172311	172603	172895	292
4641	174932	175222	175512	175802	290
7536	177825	178113	178401	178689	289
0413	180699	180986	181272	181558	287
3270	183555	183839	184123	184407	285
6108	186391	186674	186956	187239	283
8928	189210	189490	189771	190051	281
1730	192029	192289	192567	192846	279
4514	194792	195069	195346	195623	278
7281	197556	197832	198107	198382	276
0029	200303	200577	200850	201124	274
2761	203033	203305	203577	203848	272
5475	205746	206016	206286	206556	271
8173	208441	208710	208978	209247	269
0853	211121	211388	211654	211921	267
3518	213783	214049	214314	214579	266
6166	216430	216694	216957	217221	264
8798	219060	219323	219585	219846	262
1414	221675	221936	222196	222456	261
4015	224274	224533	224791	225051	260
6600	226858	227115	227372	227630	258
9170	229426	229682	229938	230193	257

N	0	1	2	3	4
170	230449	230704	230960	231215	2314
171	232996	233250	233504	233757	2340
172	235528	235781	236033	236285	2365
173	238046	238297	238548	238799	2390
174	240549	240799	241048	241297	2415
175	243038	243286	243534	243782	2440
176	245513	245759	246006	246252	2464
177	247973	248219	248464	248709	2489
178	250420	250664	250908	251151	2513
179	252853	253096	253338	253580	2538
180	255272	255514	255755	255996	2562
181	257679	257918	258158	258398	2586
182	260071	260310	260548	260787	2610
183	262451	262688	262925	263162	2633
184	264818	265054	265290	265525	2657
185	267172	267406	267641	267875	2681
186	269513	269746	269980	270212	2704
187	271842	272074	272306	272538	2727
188	274158	274389	274620	274850	2750
189	276462	276691	276921	277151	2773
190	278754	278982	279210	279439	2796
191	281033	281261	281488	281715	2819
192	283301	283527	283753	283979	2842
193	285557	285782	286007	286232	2864
194	287802	288025	288249	288473	2886
195	290035	290257	290480	290702	2909
196	292256	292478	292699	292920	2931
197	294466	294687	294907	295127	2953
198	296665	296884	297104	297323	2975
199	298853	299071	299289	299507	2997
200	301030	301247	301464	301681	3018
201	303196	303412	303628	303844	3040
202	305351	305566	305781	305996	3062
203	307496	307710	307924	308137	3083
204	309630	309843	310056	310269	3104

5	6	7	8	9	D
7724	231979	232233	232488	232742	254
2264	234517	234770	235023	235276	253
4789	237041	237292	237544	237795	252
7299	239550	239800	240050	240309	250
1795	242044	242293	242541	242790	249
4277	244524	244772	245019	245266	247
6745	246991	247236	247482	247728	246
9198	249443	249687	249932	250176	244
1638	251881	252125	252367	252610	243
4064	254306	254548	254790	255031	242
6477	256718	256958	257198	257439	241
8877	259116	259355	259594	259833	239
1263	261501	261738	261976	262214	238
3636	263873	264109	264345	264582	237
5996	266232	266467	266702	266937	235
8344	268578	268812	269046	269279	234
0679	270912	271144	271377	271609	233
3001	273233	273464	273696	273927	231
5311	275542	275772	276002	276232	230
7609	277838	278067	278296	278525	229
9895	280123	280351	280578	280806	228
2169	282395	282622	282849	283075	227
4421	284656	284882	285107	285332	226
6681	286905	287130	287354	287578	225
8920	289143	289366	289589	289812	224
1147	291369	291591	291813	292034	222
3363	293583	293804	294025	294246	222
5567	295787	296007	296226	296446	220
7760	297979	298198	298416	298635	218
9943	300160	300378	300595	300813	218
2114	302331	302547	302764	302980	216
4275	304490	304706	304921	305136	217
6425	306639	306854	307068	307282	215
8564	308778	308991	309204	309417	213
0693	310906	311118	311330	311542	212

N	0	1	2	3	4
205	311754	311966	312177	312389	312600
206	313867	314078	314289	314499	314710
207	315970	316180	316390	316599	316809
208	318063	318272	318481	318689	318898
209	320146	320354	320562	320769	320977
210	322219	322426	322633	322839	323046
211	324282	324488	324694	324899	325105
212	326336	326541	326745	326950	327155
213	328380	328583	328787	328991	329194
214	330414	330617	330819	331022	331225
215	332438	332640	332842	333044	333246
216	334454	334655	334856	335057	335257
217	336460	336660	336860	337060	337260
218	338456	338656	338855	339054	339253
219	340444	340642	340841	341039	341237
220	342423	342620	342817	343014	343212
221	344392	344589	344785	344981	345178
222	346353	346549	346744	346939	347135
223	348305	348500	348694	348889	349083
224	350248	350442	350636	350829	351023
225	352183	352375	352568	352761	352954
226	354108	354301	354493	354685	354876
227	356026	356217	356408	356599	356790
228	357935	358125	358316	358506	358695
229	359835	360025	360215	360404	360593
230	361728	361917	362105	362294	362482
231	363612	363800	363988	364176	364363
232	365488	365675	365862	366049	366236
233	367356	367542	367729	367915	368101
234	369216	369401	369587	369772	369958
235	371068	371253	371437	371622	371806
236	372912	373096	373280	373464	373647
237	374748	374932	375115	375298	375481
238	376577	376759	376942	377124	377306
239	378398	378580	378761	378943	379124

5	6	7	8	9	D
2812	313023	313234	313445	313656	211
4920	315130	315340	315551	315760	210
7018	317227	317436	317646	317854	209
9106	319314	319522	319730	319938	208
1184	321391	321598	321805	322012	207
3252	323458	323665	323871	324077	206
5310	325516	325721	325926	326131	205
7359	327563	327767	327972	328176	204
9398	329601	329805	330008	330211	203
1427	331630	331832	332034	332236	202
3447	333649	333859	335051	334253	202
5458	335658	335859	336059	336260	201
7459	337659	337858	338058	338257	200
9451	339650	339849	340047	340246	199
1435	341632	341830	342028	342225	198
3409	343606	343802	343999	344196	197
5374	345570	345766	345962	346157	196
7330	347525	347720	347915	348110	195
9278	349472	349666	349860	350054	194
1216	351410	351603	351796	351989	193
3147	353339	353532	353724	353916	193
5068	355260	355452	355643	355834	192
6981	357172	357363	357554	357744	191
8886	359076	359266	359456	359646	190
0783	360972	361161	361350	361539	189
2671	362859	363048	363236	363424	188
4551	364729	364925	365113	365301	188
6423	366610	366796	366983	367169	187
8287	368473	368659	368845	369030	186
0143	370328	370513	370698	370883	185
1991	372175	372360	372544	372728	184
3831	374015	374198	374382	374565	184
5664	375846	376029	376212	376394	183
7488	377670	377852	378034	378216	182
9306	379487	379668	379849	380030	181

N	0	1	2	3	4
240	380211	380392	380573	380754	38093
241	382017	382197	382377	382557	38273
242	383815	383995	384174	384353	38453
243	385606	385785	385964	386142	38632
244	287390	387568	387746	287923	38810
245	389166	389343	389520	389697	38987
246	390935	391112	391288	391464	39164
247	392697	392873	393048	393224	39340
248	394452	394627	294802	394977	39515
249	296199	396374	396548	396722	39689
250	397940	398114	398287	398461	39863
251	399674	399847	400020	400192	40036
252	401400	401573	401745	401917	40208
253	403120	403292	403464	403635	40380
254	404834	405005	405176	405346	40551
255	406540	406710	406881	407051	40722
256	408240	408410	408579	408749	40891
257	409933	410102	410271	410440	41060
258	411620	411788	411956	412124	41229
259	413300	413467	413635	413802	41397
260	414973	415140	415307	415474	41564
261	416640	416807	416973	417139	41730
262	418301	418467	418633	418798	41896
263	419956	420121	420286	420451	42061
264	421604	421768	421933	422097	42226
265	423246	423410	423573	423737	42390
266	424882	425045	425208	425371	42553
267	426511	426674	426836	426999	42716
268	428135	428297	428459	428621	42878
269	429752	429914	430075	430236	43039
270	431364	431525	431685	431846	43200
271	432969	433129	433290	433450	43361
272	434569	434728	434888	435048	43520
273	436163	436322	436481	436640	43679
274	437751	437909	438067	438226	43838

5	6	7	8	9	D
1115	381296	381476	381656	381837	181
2917	383097	383277	383456	383636	180
4712	384891	385070	385249	385427	179
6499	386677	386856	387034	387212	178
8279	388456	388634	388811	388989	178
00051	390228	390405	390582	390758	177
01817	391993	392169	392345	392521	176
03575	393751	393926	394101	394276	175
05326	395501	395676	395850	396025	174
07070	397245	397418	397592	397766	174
08808	398981	399154	399327	399501	174
10538	400711	400883	401056	401228	173
12261	402433	402605	402777	402949	172
13978	404149	404320	404492	404663	171
15688	405858	406029	406199	406370	171
17391	407561	407731	407900	408070	170
19087	409257	409426	409595	409764	169
20777	410946	411114	411283	411451	169
22460	412628	412796	412964	413132	168
24137	414305	414472	414639	414806	167
25808	415974	416141	416308	416474	167
27472	417638	417804	417970	418135	166
29129	419295	419460	419625	419791	165
30781	420945	421110	421275	421439	165
32426	422590	422754	422918	423082	165
34065	424228	424392	424555	424718	164
35697	425860	426023	426186	426349	163
37324	427486	427648	427811	427973	163
38944	429106	429268	429429	429591	162
40559	430720	430881	431042	431203	161
42167	432328	432488	432649	432809	160
43770	433930	434090	434249	434409	160
45366	435526	435685	435844	436003	159
46957	437116	437275	437433	437592	159
48542	438700	438859	439017	439175	158

N	0	1	2	3	4
275	439333	439491	439648	439806	439964
276	440909	441066	441224	441381	441538
277	442480	442637	442793	442950	443106
278	444045	444201	444357	444513	444669
279	445604	445760	445915	446071	446226
280	447158	447313	447468	447623	447778
281	448706	448861	449015	449170	449324
282	450249	450403	450557	450711	450865
283	451786	451940	452093	452247	452400
284	453318	453471	453624	453777	453930
285	454845	454997	455149	455302	455454
286	456366	456518	456670	456821	456973
287	457882	458033	458184	458336	458487
288	459392	459543	459694	459845	459995
289	460898	461048	461198	461348	461499
290	462398	462548	462697	462847	462997
291	463893	464042	464191	464340	464489
292	465283	465532	465680	465829	465977
293	466868	467016	467164	467312	467460
294	468347	468495	468643	468790	468938
295	469822	469969	470116	470263	470410
296	471292	471438	471585	471732	471878
297	472756	472903	473049	473195	473341
298	474216	474362	474508	474653	474799
299	475671	475816	475962	476107	476252
300	477121	477266	477411	477555	477700
301	478566	478711	478855	478999	479143
302	480007	480151	480294	480438	480582
303	481443	481586	481729	481872	482016
304	482874	483016	483159	483302	483445
305	484300	484442	484585	484727	484869
306	485721	485863	486005	486147	486289
307	487138	487280	487421	487563	487704
308	488551	488692	488833	488974	489114
309	489958	490099	490239	490380	490520

5	6	7	8	9	D
440122	440279	440437	440594	440752	158
441695	441852	442009	442166	442323	157
443263	443419	443576	443733	443889	157
444825	444981	445137	445293	445449	156
446382	446537	446692	446848	447003	155
447933	448088	448242	448397	448552	155
449478	449633	449787	449941	450095	154
451018	451172	451326	451479	451633	154
452553	452706	452859	453012	453165	153
454082	454235	454387	454540	454692	153
455606	455758	455910	456062	456214	152
457125	457276	457428	457579	457731	152
458638	458789	458940	459091	459242	151
460146	460296	460447	460597	460748	151
461649	461799	461948	462098	462248	150
463146	463296	463445	463594	463744	150
464639	464787	464936	465085	465234	149
466126	466274	466423	466571	466719	149
467608	467756	467904	468052	468200	148
469085	469233	469380	469527	469675	147
470557	470704	470851	470998	471145	147
472025	472171	472318	472464	472610	146
473487	473633	473779	473925	474071	146
474944	475090	475235	475381	475526	146
476397	476542	476687	276832	476976	145
477844	477989	478133	478278	478422	145
479287	479431	479575	479719	479863	144
480725	480869	481012	481156	481299	144
482159	482302	482445	482588	482731	143
483587	483730	483872	484015	484157	143
485011	485153	485295	485437	485579	142
486430	486572	486714	486855	486997	142
487845	487986	488127	488269	488410	141
489255	489396	419537	489677	489818	141
490661	490801	490941	491081	491222	140

N	0	1	2	3	4
310	491362	491502	491642	491782	491922
311	492760	492900	493040	493179	493319
312	494155	494294	494433	494572	494711
313	495544	495683	495822	495960	496099
314	496930	497068	497206	497344	497482
315	498311	498448	498586	498724	498862
316	499687	499824	499962	500099	500236
317	501059	501196	501333	501470	501607
318	502427	502564	502700	502837	502973
319	503791	503927	504063	504199	504335
320	505150	505286	505421	505557	505692
321	506505	506640	506775	506911	507046
322	507856	507991	508125	508260	508395
323	509202	509337	509471	509606	509740
324	510545	510679	510813	510947	511081
325	511883	512017	512150	512284	512417
326	513218	513351	513484	513617	513750
327	514548	514681	514813	514946	515079
328	515874	516006	516139	516271	516403
329	517196	517328	517460	517592	517724
330	518514	518645	518777	518909	519040
331	519828	519959	520090	520221	520352
332	521138	521269	521400	521530	521661
333	522444	522575	522705	522835	522966
334	523746	523876	524006	524136	524266
335	525045	525174	525304	525433	525563
336	526339	526468	526598	526727	526856
337	527630	527759	527888	528016	528145
338	528917	529045	529174	529302	529430
339	530200	530328	530456	530584	530712
340	531479	531607	531734	531862	531989
341	532754	532882	533009	533136	533263
342	534026	534153	534280	534407	534534
343	535294	535421	535547	535674	535800
344	536558	536685	536811	536937	537063

5	6	7	8	9	D
492062	492201	492341	492481	492621	140
493458	493597	493737	493876	494015	139
494850	494989	495128	495267	495406	139
496237	496376	496514	496653	496791	139
497621	497759	497897	398035	498173	138
498999	499137	499275	499412	499550	138
500374	500511	500648	500785	500922	137
501744	501880	502017	502154	502290	137
503109	503246	503382	503518	503654	136
504471	504607	504743	504878	505014	136
505828	505963	506099	506234	506370	136
507181	507316	507451	507586	507721	135
508530	508664	508799	508933	509068	135
509874	510008	510143	510277	510411	134
511215	511348	511482	511616	511750	134
512551	512684	512818	512951	513084	134
513883	514016	514149	514282	514415	133
515211	515344	515476	515609	515741	132
516535	516668	516800	516932	517064	132
517855	517987	518119	518251	518382	131
519171	519303	519434	519566	519697	131
520483	520614	520745	520876	521007	131
521792	521922	522053	522183	522314	131
523096	523226	523356	523486	523616	130
524396	524526	524656	524785	524915	130
525692	525822	525951	526081	526210	129
526985	527114	527243	527372	527501	129
528274	528402	528531	528660	528788	129
529559	529687	529815	529943	530072	228
530840	530968	531095	531223	531351	128
532117	532245	532372	532500	532627	128
533391	533518	533645	533772	533899	128
534661	534787	534914	535041	535167	127
535927	536053	536179	536306	536432	127
537189	537315	537441	537567	537693	126

N	0	1	2	3	4
345	537819	537945	538071	538197	538322
346	539076	539202	539327	539432	539578
347	540329	540455	540580	540705	540830
348	541579	541704	541829	541953	542078
349	542825	542950	543074	543199	543323
350	544068	544192	544316	544440	544564
351	545307	545431	545555	545678	545802
352	546543	546666	546789	546913	547036
353	547775	547898	548021	548144	548267
354	549003	549126	549249	549371	549494
355	550228	550351	550473	550595	550717
356	551450	551572	551694	551816	551938
357	552668	552790	552911	553033	553155
358	553885	554004	554126	554247	554368
359	555094	555215	555336	555457	555578
360	556303	556423	556544	556664	556785
361	557507	557627	557748	557868	557988
362	558709	558829	558948	559068	559188
363	559907	560026	560146	560265	560385
364	561101	561221	561340	561459	561578
365	562293	562412	562531	562650	562709
366	563481	563600	563718	563837	563955
367	564666	564784	564903	565021	565139
368	565848	565966	566084	566202	566320
369	567026	567144	567262	567379	567497
370	568202	568319	568436	568554	568671
371	569374	569491	569608	569725	569842
372	570543	570660	570776	570892	571010
373	571709	571825	571942	572058	572174
374	572872	572988	573104	573220	573336
375	574031	574147	574263	574379	574494
376	575188	575303	575419	575534	575650
377	576341	576457	576572	576687	576802
378	577492	577607	577722	577836	577951
379	578639	578754	578868	578983	579097

5	6	7	8	9	D
538448	538574	538699	538825	538951	126
539703	539829	539954	540079	540204	125
540955	541080	541205	541330	541454	125
542203	542327	542452	542576	542701	125
543447	543571	543696	543820	543944	124
544688	544812	544936	545060	545183	124
545925	546049	546172	546296	546419	124
547159	547282	547405	547529	547652	123
548389	548512	548635	548758	548881	123
549616	549739	549861	549984	550106	123
550840	550962	551084	551206	551328	122
552059	552181	552303	552425	552547	122
553276	553398	553519	553640	553762	121
554489	554610	554731	554852	554973	121
555699	555820	555940	556061	556182	121
556905	557026	557146	557267	557387	120
558108	558228	558349	558469	558589	120
559308	559428	559548	559667	559787	120
560504	560624	560743	560863	560982	119
561698	561817	561936	562055	562174	119
562887	563006	563125	563244	563362	119
564074	564192	564311	564429	564548	119
565257	565376	565494	565612	565730	118
566437	566555	566673	566791	566909	118
567614	567732	567849	567967	568084	118
568788	568905	569023	569140	569257	117
569959	570076	570193	570309	570426	117
571126	571243	571359	571476	571592	117
572291	572407	572523	572639	572755	116
573452	573568	573684	573800	573915	116
574610	574726	574841	574957	575072	116
575765	575880	575996	576111	976226	115
576917	577032	577147	577262	577377	115
578066	578181	578295	578410	578525	115
579212	579326	579441	579555	579669	114

N	0	1	2	3	4
380	579784	579898	580012	580126	580240
381	580925	581039	581153	581267	581381
382	582063	582177	582291	582404	582518
383	583199	583312	583425	583539	583652
384	584331	584444	584557	584670	584783
385	585461	585573	585686	585799	585912
386	586587	586700	586812	586925	587037
387	587711	587823	587935	588047	588160
388	588832	588944	589055	589167	589279
389	589950	590061	590173	590284	590396
390	591065	591176	591287	591398	591510
391	592177	592288	592399	592510	592621
392	593286	593397	593508	593618	593729
393	594392	594503	594613	594724	594834
394	595496	595606	595717	595827	595937
395	596597	596707	596817	596927	597037
396	597695	597805	597914	598024	598134
397	598790	598900	599009	599119	599228
398	599883	599992	600101	600210	600319
399	600973	601082	601190	601299	601408
400	602060	602168	602277	602386	602494
401	603144	603253	603361	603469	603577
402	604226	604334	604442	604550	604658
403	605305	605413	605520	605628	605736
404	606381	606489	606596	606704	606811
405	607455	607562	607669	607777	607884
406	608526	608633	608740	608847	608954
407	609594	609701	609808	609914	610021
408	610660	610767	610873	610979	611086
409	611723	611829	611936	612042	612148
410	612784	612890	612996	613101	613207
411	613842	613947	614053	614159	614264
412	614897	615003	615108	615213	615319
413	615950	616055	616160	616265	616370
414	617000	617105	617210	617315	617420

5	6	7	8	9	D
580355	580469	580583	580697	580811	114
581494	581608	581722	581836	581950	114
582631	582745	582859	582972	583085	113
583765	583879	583992	584105	584218	113
584896	585009	585122	585235	585348	113
586024	586137	586250	586362	586475	112
587149	587262	587374	587486	587599	112
588272	588384	588496	588608	588720	112
589391	589503	589615	589726	589838	112
590507	590619	590730	590842	590953	111
591621	591732	591843	591955	592066	111
592732	592843	592954	593064	593175	111
593840	593950	594061	594171	594282	111
594945	595055	595165	595276	595386	111
596047	596157	596267	596377	596487	110
597146	597256	597366	597476	597586	109
598243	598353	598462	598572	598681	109
599337	599446	599556	599665	599774	109
600428	600537	600646	600755	600864	109
601517	601625	601734	601843	601951	109
602603	602711	602819	602928	603036	109
603685	603794	603902	604010	604118	108
604766	604874	604982	605089	605197	108
605843	605951	606059	606166	606274	107
606918	607026	607133	607240	607348	107
607991	608098	608205	608312	608419	107
609060	609167	609274	609381	609488	107
610128	610234	610341	610447	610554	107
611192	611298	611405	611511	611617	106
612254	612360	612466	612572	612678	106
613313	613419	613525	613630	613736	106
614370	614475	614581	614686	614792	106
615424	615529	615634	615740	615845	105
616475	616580	616685	616790	616895	105
617524	617629	617734	617839	617943	105

N	0	1	2	3	4
415	618048	618153	618257	618362	618466
416	619093	619198	619302	619406	619511
417	620136	620240	620344	620448	620552
418	621176	621280	621384	621488	621592
419	622214	622318	622421	622525	622628
420	623249	623353	623456	623559	623663
421	624282	624385	624488	624591	624695
422	625312	625415	625518	625621	625724
423	626340	626443	626546	626648	626751
424	627366	627468	627571	627673	627775
425	628389	628491	628593	628695	628797
426	629410	629511	629613	629715	629817
427	630428	630530	630631	630733	630835
428	631444	631545	631647	631748	631849
429	632457	632559	632660	632761	632862
430	633468	633569	633670	633771	633872
431	634477	634578	634679	634779	634880
432	635484	635584	635685	635785	635886
433	636488	636588	636688	636789	636889
434	637490	637590	637690	637790	637890
435	638489	638589	638689	638789	638888
436	639486	639586	639686	639985	639885
437	640481	640581	640680	640779	640879
438	641475	641573	641672	641771	641871
439	642465	642563	642662	642761	642860
440	643453	643551	643650	643749	643847
441	644439	644537	644636	644734	644832
442	645421	645521	645619	645717	645815
443	646404	646502	646600	646698	646796
444	647383	647481	647579	647676	647774
445	648360	648458	648555	648653	648750
446	649335	649432	649530	649627	649724
447	650308	650405	650502	650599	650696
448	651278	651375	651472	651569	651666
449	652246	652343	652440	652536	652633

5	6	7	8	9	D
618571	618676	618780	618884	618989	105
619615	619719	619824	619928	620032	104
620656	620760	620864	620968	621072	104
621695	621799	621903	622007	622110	104
622732	622835	622939	623042	623146	104
623766	623869	623973	624076	624179	103
624798	624901	625004	625107	625209	103
625827	625929	626032	626135	626238	103
626853	626959	627058	627161	627263	103
627878	627980	628082	628185	628287	192
628900	629002	629104	629206	629308	102
629919	630021	630123	630224	630326	102
630936	631038	631139	631241	631342	102
631951	632052	632153	632255	632356	101
632963	633064	633165	633266	633367	101
633973	634074	634175	634276	634376	100
634981	635081	635182	635283	635383	100
635986	636087	636187	636288	636388	100
636989	637089	637189	637289	637390	100
637990	638090	638190	638289	638389	99
638988	639088	639188	639287	639387	99
639984	640084	640183	640283	640382	99
640978	641077	641177	641276	641375	99
641970	642069	642168	642267	642366	99
642959	643058	643156	643255	643354	99
643946	644044	644143	644242	644340	98
644931	645029	645127	645226	645324	98
645913	646011	646109	646208	646306	98
646894	646992	647089	647187	647285	98
647872	647969	648067	648165	648262	98
648848	648945	649043	649140	649237	97
649821	649919	650016	650113	650210	97
650793	650890	650987	651084	651181	97
651762	651859	651956	652053	652150	97
652730	652826	652923	653019	653116	97

N	0	1	2	3	4
450	653212	653309	653405	653502	653598
451	654176	654273	654369	654465	654562
452	655138	655234	655331	655427	655523
453	656098	656194	656290	656386	656481
454	657056	657151	657247	657343	657438
455	658011	658107	658202	658298	658393
456	658965	659060	659155	659250	659346
457	659916	660011	660106	660201	660296
458	660865	660960	661055	661150	661245
459	661813	661907	662002	662098	662191
460	662758	662852	662947	663041	663135
461	663701	663795	663889	663983	664078
462	664642	664736	664830	664924	665018
463	665581	665675	665768	665862	665956
464	666518	666612	666705	666799	666892
465	667453	667546	667640	667733	667826
466	668386	668479	668572	668665	668758
467	669317	669410	669503	669596	669689
468	670246	670339	670431	670524	670617
469	671173	671265	671358	671451	671543
470	672098	672190	672283	672375	672467
471	673021	673113	673205	673297	673390
472	673942	674034	674126	674218	674310
473	674861	674953	675045	675136	675228
474	675778	675870	675961	676053	676145
475	676694	676785	676876	676968	677059
476	677607	677698	677789	677881	677972
477	678518	678609	678700	678791	678882
478	679428	679519	679610	679700	679791
479	680335	680426	680517	680607	680698
480	681241	681332	681422	681513	681603
481	682145	682235	682326	682416	682506
482	683047	683137	683227	683317	683407
483	683947	684037	684127	684217	684307
484	684845	684935	685025	685114	685204

5	6	7	8	9	D
653695	653791	653888	653984	654080	97
654658	654754	654850	654946	655042	96
655619	655714	655710	655906	656002	96
656577	656673	656769	656864	656960	96
657534	657629	657725	657820	657916	96
658488	658584	658679	658774	658870	95
659441	659536	659631	659726	659821	95
660391	660486	660581	660676	660771	95
661339	661434	661529	661623	661718	94
662285	662380	662474	662569	662663	94
663230	663324	663418	663512	663607	94
664172	664265	664360	664454	664548	94
665112	665206	665299	665393	665487	94
666050	666143	666237	666331	666424	94
666986	667079	667173	667266	667359	94
667920	668013	668106	668199	668293	94
668852	668945	669038	669131	669224	94
669782	669874	669967	670060	670153	93
670710	670802	670895	670988	671080	93
671636	671728	671821	671913	672005	93
672560	672652	672744	672836	672929	93
673482	673574	673666	673758	673850	92
674402	674494	674586	674677	674769	92
675320	675412	675503	675595	675687	92
676236	676328	676419	676511	676602	91
677150	677242	677333	677424	677516	91
678063	678154	678245	678336	678427	91
678973	679064	679155	679246	679337	91
679882	679973	680063	680154	680245	91
680789	680879	680970	681060	681151	91
681693	681784	681874	681964	682055	90
682596	682686	682777	682867	682957	90
683497	683587	683677	683767	683857	90
684396	684486	684576	684666	684756	90
685294	685383	685473	685563	685652	90

N	0	1	2	3	4
485	685741	685831	685921	686010	686100
486	686636	686726	686815	686904	686994
487	687529	687618	687707	687796	687885
488	688420	688509	688598	688687	688776
489	689309	689398	689486	689575	689664
490	690196	690285	690373	690462	690550
491	691081	691170	691258	691347	691435
492	691965	692053	692142	692230	692318
493	692847	692935	693023	693111	693199
494	693727	693815	693903	693991	694078
495	694605	694693	694781	694868	694956
496	695482	695570	695657	695744	695832
497	696356	696445	696531	696618	696706
498	697229	697317	697404	697491	697578
499	698101	698188	698275	698362	698449
500	698970	699057	699144	699231	699317
501	699838	699924	700011	700098	700184
502	700704	700790	700877	700963	701049
503	701568	701654	701741	701827	701913
504	702430	702517	702603	702689	702775
505	703291	703377	703463	703549	703635
506	704151	704236	704322	704400	704494
507	705008	705094	705179	705265	705350
508	705864	705949	706035	706120	706206
509	706718	706803	706888	706974	707059
510	707570	707655	707740	707826	707911
511	708421	708506	708591	708676	708761
512	709270	709455	709440	709524	709609
513	710117	710202	170287	710371	710456
514	710963	711048	711132	711217	711501
515	711807	711892	711976	712060	712144
516	712650	712734	712818	712902	712986
517	713491	713575	713659	713742	713826
518	714330	714414	714497	714581	714665
519	715167	715251	715335	715415	715501

	6	7	8	9	D
89	686279	686368	686458	686547	89
83	687172	687261	687351	687440	89
75	688064	688153	688242	688331	89
65	688953	689042	689131	689220	89
53	689841	689930	690019	690107	89
39	690727	690816	690905	690993	89
24	691612	691706	691789	691877	88
06	692594	692583	692671	692759	88
87	693375	693463	693551	693639	88
66	694254	694342	694430	694517	88
44	695131	695219	695307	695404	88
19	696007	696094	696182	696270	87
95	696880	696968	697055	697142	87
65	697752	697839	697926	698014	87
37	698622	698709	698706	698883	87
04	699491	699578	699664	699751	87
71	700358	700444	700531	700617	87
36	701222	701309	701395	701482	86
99	702086	702172	702258	702344	86
61	702947	703033	703119	703205	86
21	703807	703893	703979	704065	86
79	704665	704751	704837	704922	86
36	705522	705607	705693	705778	86
91	706376	706462	706547	706632	85
44	707229	707315	707400	707485	85
96	708081	708166	708251	708336	85
46	708931	709015	709100	709185	85
94	709779	709863	709948	710033	85
40	710625	710710	710794	710879	85
85	711469	711554	711639	711722	84
29	712313	712397	712481	712566	84
70	713154	713238	713323	713407	84
10	713994	714078	714162	714246	84
49	714833	714916	715000	715084	84
86	715669	715753	715836	715920	84

N	0	1	2	3	4
520	716003	716087	716170	716254	7163
521	7168.8	716921	717004	717088	7171
522	717671	717754	717837	717920	7180
523	718502	718585	718668	718751	7188
524	719331	719414	719497	719580	7196
525	720159	720242	720325	720407	7204
526	720986	721068	721151	721233	7213
527	721811	720893	721975	722058	7221
528	722633	722714	722798	722881	7229
529	7234.6	723538	723620	723702	7237
530	724276	724358	724440	7.4522	7246
531	725092	725176	725258	725340	7254
332	725912	725993	726075	726156	7262
533	726727	726809	726890	726972	7270
5.4	727541	727623	727704	727785	7278
535	728354	728435	728516	728597	7286
536	729165	729246	729327	729408	7294
537	729974	730055	730136	730217	7302
538	730782	730863	730944	731024	7311
539	731589	731569	731750	731830	7319
540	732394	732474	732555	732635	7327
541	733197	733278	733358	733438	7335
542	733999	734079	734159	734240	7343
543	734800	734880	734960	735040	7351
544	735599	735679	735759	735838	7359
545	736397	736476	736556	736635	7327
546	737193	737272	737352	737431	7335
547	737987	738067	738146	738225	7383
548	738781	738860	738939	739018	7351
549	739572	739651	739731	739810	7398
550	740363	740442	740521	740599	7406
551	741152	741230	741309	741388	7414
552	741939	742018	742096	742175	7422
553	742725	742804	742882	742961	7430
554	743510	743588	743667	743745	7438

	6	7	8	9	D
421	716504	716588	716671	716754	83
254	717338	717421	717504	717587	83
086	718169	718253	718336	718419	83
917	719000	719083	719165	719248	83
745	719828	719911	719994	720077	83
573	720655	720738	720821	720903	83
398	721481	721563	721646	721728	82
222	722305	722387	722469	722552	82
045	723127	723209	723291	723374	82
866	723948	724030	724112	724194	82
685	724767	724849	724931	725013	82
503	725585	725667	725748	725830	82
320	726401	726483	726564	726646	82
134	727216	727297	727379	727460	81
948	728029	728110	728191	728273	81
759	728841	728922	729003	729084	81
570	729651	729732	729813	729893	81
378	730459	730540	730621	730702	81
186	731266	731347	731428	731508	81
991	732072	732152	732233	732313	81
796	732876	732956	733037	733117	80
598	733679	733759	733139	733919	80
400	734480	734560	734640	734720	80
199	735279	735359	735439	735519	80
998	736078	736157	736237	736317	80
795	736874	736954	737034	737113	80
590	737670	737749	737829	737908	79
384	738463	738543	738622	738701	79
177	739256	739335	739414	739493	79
968	740047	740126	740205	740284	79
757	740836	740915	740994	741073	79
546	741624	741703	741782	741860	79
332	742411	742489	742568	742641	79
118	743196	743275	743353	743431	78
902	743980	744058	744136	744215	78

N	0	1	2	3	4
555	744293	744371	744449	744528	74460
556	745075	745153	745231	745309	74538
557	745855	745933	746011	746089	74616
558	746634	746712	746790	746868	74694
559	747412	747489	747567	747645	74772
560	748188	748266	748343	748421	74849
561	748963	749040	749118	749195	74927
562	749736	749814	749891	749968	75004
563	750508	750586	750663	750740	75081
564	751279	751356	751433	751510	75158
565	752048	752125	752202	752279	75235
566	752816	752893	752970	753047	75312
567	753583	753660	753736	753813	75388
568	754348	754425	754501	754578	75465
569	755112	755189	755265	755341	75541
570	755875	755951	756027	756103	75617
571	756636	756712	756788	756864	75694
572	757396	757472	757548	757624	75770
573	758155	758230	758306	758382	75845
574	758912	758988	759063	759139	75921
575	759668	759743	759819	759894	75997
576	760422	760498	760573	760649	76072
577	761176	761251	761326	761402	76147
578	761928	762003	762078	762153	76222
579	762679	762754	762829	762904	76297
580	763428	763503	763578	763653	76372
581	764176	764251	764326	764400	76447
582	764923	764998	765072	765147	76522
583	765669	765743	765818	765892	76596
584	766416	766487	766561	766636	76671
585	767156	767230	767304	767379	76745
586	767898	767972	768046	768120	76819
587	768638	768712	768786	768860	76893
588	769377	769451	769525	769599	76967
589	770115	770189	770263	770336	77041

5	6	7	8	9	D
684	744762	744840	744919	744997	78
465	745543	745621	745699	745777	78
245	746323	746401	746479	746556	78
023	747101	747179	747256	747334	78
800	747877	747955	748033	748110	78
576	748653	748731	748808	748885	77
350	749427	749504	749582	749659	77
123	750200	750277	750354	750431	77
894	750971	751048	751125	751202	77
664	751741	751818	751895	751972	77
433	752509	752586	752663	752740	77
200	753277	753353	753430	753506	77
966	754042	754119	754195	754272	77
730	754807	754883	754960	755036	76
494	755570	755646	755722	755799	76
256	756332	756408	756484	756560	76
016	757092	757168	757244	757320	76
775	757851	757927	758003	758079	76
533	758609	758685	758761	758836	76
290	759366	759441	759517	759592	76
045	760121	760196	760272	760347	75
799	760875	760950	761026	761101	75
552	761627	761702	761778	761853	75
303	762378	762453	762529	762604	75
053	763128	763203	763278	763353	75
802	763877	763952	764027	764101	75
550	764624	764699	764774	764848	75
296	765370	765445	765519	765594	75
041	766115	766190	766264	766338	74
785	766859	766933	767007	767082	74
527	767601	767675	767749	767823	74
268	768342	768416	768490	768564	74
008	769082	769156	769230	769303	74
746	769820	769894	769968	770042	74
484	770557	770631	770705	770778	74

N	0	1	2	3	4
590	770852	770926	770999	771073	771
591	771587	771661	771734	771808	771
592	772322	772395	772468	772544	772
593	773055	773128	773201	773276	773
594	773786	773860	773933	774006	774
595	774517	774590	774663	774736	774
596	775246	775319	775392	775465	775
597	775974	776047	776120	776193	776
598	776701	776774	776846	776919	776
599	777427	777499	777572	777644	777
600	778151	778224	778296	778368	778
601	778874	778947	779019	779091	779
602	779596	779669	779741	779813	779
603	780317	780389	780461	780533	780
604	781037	781109	781181	781253	781
605	781755	781827	781899	781971	782
606	782473	782544	782616	782688	782
607	783189	783260	783332	783403	783
608	783904	783975	784046	784118	784
609	784617	784689	784760	784831	784
610	785330	785401	785472	785543	785
611	786041	786112	786183	786254	786
612	786751	786822	786893	786964	787
613	787460	787531	787602	787673	787
614	788168	788239	788310	788381	788
615	788875	788946	789016	789087	789
616	789581	789651	789722	789792	789
617	790285	790356	790426	790496	790
618	790988	791059	791129	791199	791
619	791691	791761	791831	791901	791
621	792392	792462	792532	792602	792
622	793092	793162	793231	793301	793
623	793790	793868	793930	794000	794
624	794483	794550	794627	794697	794
625	795185	795254	795324	795393	795

5	6	7	8	9	D
220	771293	771367	771440	771514	74
955	772028	772102	772175	772248	73
688	772762	772835	772908	772981	73
421	773491	773567	773640	773713	73
152	774225	774298	774371	774444	73
4852	774955	775028	775100	775173	73
5610	775683	775756	775829	775902	73
6338	776411	776483	776556	776629	73
7064	777137	777209	777282	777354	73
7789	777862	777934	778006	778079	72
8513	778585	778658	778720	778802	72
9236	779308	779380	779452	779524	72
9957	780029	780101	780173	780245	72
0677	780749	780821	780893	780965	72
1396	781468	781540	781612	781684	72
2114	782186	782258	782329	782401	72
2831	782902	782974	783046	783117	72
3546	783618	783689	783761	783832	71
4261	784332	784403	784475	784546	71
4974	785045	785116	785187	785259	71
5686	785757	785828	785899	785970	71
6396	786467	786538	786609	786680	71
7106	787177	787248	787319	787389	71
7815	787885	787956	788027	788098	71
8522	788593	788662	788734	788804	71
9228	789299	789369	789440	789510	71
9933	790004	790074	790144	790215	70
0637	790707	790778	790848	790918	70
1340	791410	791480	791560	791620	70
2041	792111	792181	792252	792322	70
2742	792812	792882	792952	793022	70
3441	793511	793581	793651	793721	70
4139	794209	794279	794349	794418	70
4836	794906	794976	795045	795119	70
5532	795602	795672	795741	795810	70

N	0	1	2	3	4
625	795880	795949	796019	796088	7961
626	796574	796644	796713	796782	7968
627	797268	797337	797406	797475	7975
628	797960	798029	798098	798167	7982
629	798651	798720	798789	798858	7989
630	799341	799409	799478	799547	7996
631	800029	80 .098	800167	800236	8003
632	800717	800786	800854	800923	8009
633	801404	801472	801541	801609	8016
634	802089	802158	802226	802295	8023
635	802774	802842	802910	802979	8030
636	803457	803525	803594	803662	8037
637	804139	804203	804276	804344	8044
608	804821	804889	804957	805025	8050
629	805501	805569	805637	805705	8057
640	806180	806248	806316	806384	8064
641	806858	806926	806993	807061	8071
642	807535	807623	807670	807738	8078
643	808211	808279	808346	808414	8084
644	808886	808953	809021	809088	8091
645	809560	809627	809694	809762	8098
646	810233	810301	810367	810434	8105
647	810904	810971	811039	811106	8111
648	811575	811642	811709	811776	8118
649	812245	812312	812379	812445	8125
650	812913	812980	813047	813114	8131
651	813581	813648	813714	813781	8138
652	814248	814314	814381	814447	8145
653	814913	814980	815046	815113	8151
654	815578	815644	815711	815777	8158
655	816241	816241	816374	816440	8165
656	816904	816904	817036	817102	8171
657	817565	817565	817698	817764	8178
658	818226	818226	818358	818424	8184
659	818885	818885	819017	819083	8191

5	6	7	8	9	D
6227	796297	796366	796436	796505	69
6921	796990	797060	797129	797198	69
7614	797683	797752	797821	797890	69
8305	798374	798443	798513	798582	69
8996	799065	799134	799203	799272	69
9685	799754	799823	799892	799961	69
0373	800442	800511	800580	800648	69
1061	801129	801198	801266	801335	69
1747	801815	801884	801952	802021	69
2432	802500	802568	802637	802705	68
3116	803184	803252	803321	803389	68
3798	803857	803935	804003	804071	68
4480	804548	804616	804685	804753	68
5161	805219	805297	805365	805433	68
5840	805908	805976	806044	806112	68
6519	806587	806655	806722	806790	68
7197	807264	807332	807400	807467	68
7873	807941	808008	808076	808143	68
8548	808616	808684	808751	808818	67
9223	809290	809358	809425	809492	67
9896	809964	810031	810098	810165	67
0569	810636	810703	810770	810837	67
1240	811307	811374	811441	811508	67
1910	811977	812044	812111	812178	67
2579	812646	812713	812780	812847	67
3247	813314	813381	813448	813514	66
3914	813981	814048	814114	814181	66
4581	814647	814714	814780	814847	66
5246	815312	815379	815445	815511	66
5910	815976	816042	816109	816175	66
6573	816639	816705	816771	816838	66
7235	817301	817367	817433	817499	66
7896	817962	818028	818094	818160	66
8556	818622	818688	818754	818819	66
9215	819281	819347	819412	819478	66

N	0	1	2	3	4
660	819514	819610	819676	819741	8198
661	820202	820267	820333	820399	8204
662	820858	820924	820989	821055	8211
663	821514	821579	821645	821710	8217
664	822168	822233	822299	822361	8244
665	822822	822887	822952	823018	8230
666	823474	823539	823605	823670	8237
667	824126	824191	824256	824321	8243
668	824777	824842	824907	824972	8250
669	825426	825491	825556	825621	8256
670	826075	826140	826204	826269	8263
671	826723	826787	826852	826917	8269
672	827369	827434	827499	827563	8276
673	828015	828080	828144	828209	8282
674	828660	828724	828789	828853	8289
675	829334	829368	829432	829497	8295
676	829947	830011	830075	830139	8302
677	830589	830653	830717	830781	8308
678	831230	831294	831358	831422	8314
679	831870	831931	831998	832062	8321
680	832509	832573	832636	832700	8327
681	833147	833211	833275	833338	8334
682	833784	833848	833912	833975	8340
683	834411	834484	834548	834611	8346
684	835056	835120	835183	835247	8353
685	835691	835754	835817	835881	8359
686	836324	836387	836451	836514	8365
687	836957	837020	837083	837146	8372
688	837588	837652	837715	837778	8378
689	838219	838282	838345	838408	8384
690	838849	838912	838975	839038	8391
691	839478	839541	839604	839667	8397
692	840106	840169	840232	840294	8403
693	840733	840795	840859	840921	8409
694	841359	841422	841485	841547	8416

5	6	7	8	9	D
8872	819939	820004	820070	820136	66
9530	820596	820661	820727	820792	66
0186	821251	821317	821382	821448	66
0841	821906	821972	822037	822102	65
1495	822560	822626	822691	822756	65
2148	823213	823279	823344	823409	65
2800	823865	823930	823996	824061	65
3451	824516	824581	824646	824711	65
4101	825166	825231	825296	825361	65
4751	825815	825880	825945	826009	65
5399	826464	826528	826593	826658	65
6046	827111	827175	827240	827305	65
6692	827757	827821	827886	827951	65
7338	828402	828867	828531	828596	64
7982	829046	829111	829175	829240	64
8625	829690	829754	829818	829882	64
9268	830332	830396	830460	830525	64
9909	830973	831037	831102	831166	64
0550	831614	831678	831742	831806	64
1189	832253	832317	832381	832445	64
1828	832892	832956	833019	833083	64
2465	833530	833593	833657	833721	64
3103	834166	834230	834294	834357	64
3739	834702	834866	834929	834993	64
4373	835437	835500	835564	835627	63
5007	836071	836134	836197	836261	63
5641	836704	836767	836830	836894	63
6273	837336	837399	837461	837525	63
6904	837967	838030	838093	838156	63
7534	828597	838660	838723	838786	63
8164	839237	839289	839352	839415	63
8792	839855	839918	839981	840043	63
9420	840482	840545	840608	840671	63
0046	841109	841172	841234	841297	63
0672	841735	841797	841860	841922	63

N	0	1	2	3	4
695	841985	842047	842110	842172	84323
696	842609	842672	842734	842796	84285
697	843233	843295	843357	843420	84348
698	843855	843918	843980	944042	84410
699	841477	841539	844601	844664	84472
700	845098	845160	845222	845284	84534
701	845718	845780	845842	845904	84596
702	846337	846399	846461	846523	84658
703	846955	847017	847079	847141	84720
704	847573	847634	847696	847758	84781
705	848189	848251	848312	848374	84843
706	848805	848866	848928	848989	84905
707	849419	849481	849542	849604	84966
708	850033	850095	850156	850217	84027
709	850646	850707	850769	850830	85089
710	851258	851319	851381	851442	85150
711	851869	851931	851992	852053	85211
712	852480	852541	852602	852663	85272
713	853089	853150	853211	853272	85333
714	853698	853759	853820	853881	85394
715	854306	854367	854428	854483	85454
716	854913	854974	855034	855095	85585
717	855519	855580	855640	855701	85576
718	856124	856185	856245	856306	85636
719	856729	856789	856850	856910	85697
720	857333	857393	857453	857513	85757
721	857935	857995	858056	858116	85817
722	858537	858597	858657	858718	85877
723	859138	859198	859258	859318	85937
724	859739	859799	859859	859918	85997
725	860338	860398	860458	860518	86057
726	860937	860996	861056	871116	86117
727	861534	861594	861654	861714	86177
728	862131	862191	862251	862310	86237
729	862727	862787	862847	862906	86296

5	6	7	8	9	D
842297	842360	842422	842484	842547	62
842921	842983	843046	843108	843170	62
843544	843606	843669	843731	843793	62
844166	844229	844291	844353	844415	62
844788	844850	844912	844974	845036	62
845408	845470	845532	845594	845656	62
846028	846090	846151	846213	846275	62
846646	846708	846770	846832	846894	62
847264	847326	847388	847449	847511	62
847881	847943	848004	848066	848127	62
848497	848559	848620	848682	848743	62
849112	849174	849235	849297	849358	61
849726	849788	849849	849911	849972	61
850340	850401	850462	850524	850585	61
850952	851014	851075	851136	851197	61
851564	851625	851686	851747	851809	61
852175	852236	852297	852358	852419	61
852785	852846	852907	852968	853029	61
853394	853455	853516	853576	853637	61
854002	854063	854124	854184	854245	61
854610	854670	854731	854792	854852	61
855216	855277	855337	855398	855459	61
855821	855882	855943	856003	856064	61
856427	856487	856548	856608	856668	60
857033	857091	857151	857212	857272	60
857634	857694	857754	857815	857875	60
858236	858296	858357	858417	858477	60
858838	858898	858958	859018	859078	60
859439	859499	859559	859619	859679	60
860038	860098	860158	860218	860278	60
860637	860697	860757	860817	860877	60
861236	861295	861355	861415	861475	60
861833	861893	861952	862011	862072	60
862430	862489	862549	862608	862668	60
863025	863085	863144	863204	863263	60

N	0	1	2	3	4
730	863323	863382	863442	863501	863561
731	863917	863977	864036	864096	864155
732	864511	864570	864630	864689	864748
733	865104	865163	865222	865282	865341
734	865696	865755	865815	865873	865933
735	866287	866346	866405	866465	866524
736	866878	866937	866996	867055	867114
737	867467	867526	867585	867644	867703
738	868058	868115	868174	868233	868292
739	868644	868703	868762	868821	868879
740	869232	869290	869349	869408	869466
741	869818	869877	869935	869994	870053
742	870404	870462	870521	870579	870638
743	870989	871047	871106	871164	871223
744	871573	871631	871690	871708	871806
745	872156	872215	872273	872332	872389
746	872739	872797	872855	872913	872972
747	873321	873379	873437	873495	873553
748	873902	873960	874018	874076	874134
749	874482	874540	874598	874656	874714
750	875061	875119	875177	873235	875293
751	875640	875698	875756	875813	875871
752	876218	876276	876333	876391	876449
753	876795	876853	876910	876968	877026
754	877371	877429	877488	877544	877602
755	877947	878004	878062	878119	878177
756	878522	878579	878637	878694	878751
757	879096	879153	879211	879268	879325
758	879669	879736	879784	879841	879898
759	880242	880299	870356	880413	880471
760	880814	880871	880928	880985	881042
761	881385	881442	881499	881556	881613
762	881955	882012	882069	882126	882183
763	882524	882581	882638	882695	882752
764	883093	883050	883207	883266	883321

5	6	7	8	9	D
863620	863680	863739	863798	863858	59
864214	864274	864333	864392	864452	59
864808	864867	864926	864985	865045	59
865400	865459	865518	865578	865637	59
865992	866051	866110	866169	866228	59
866583	866642	866701	866760	866819	59
867173	867232	867291	867350	867409	59
867762	867821	867880	867939	867997	59
868350	868409	868468	868527	868586	59
868938	868997	869056	869114	869173	59
869525	869584	869642	869701	869760	59
870111	870170	870228	870287	870345	59
870696	870755	870813	870872	870930	58
871281	871339	871398	871456	871515	58
871865	871923	871981	872040	872098	58
872448	822506	872564	872622	872681	58
873030	873088	873146	873204	873262	58
873611	873669	873727	873785	873843	58
874192	874250	874308	874366	874424	58
874772	874830	874887	874945	875003	58
875351	875409	875466	875524	875582	58
875929	875987	876044	876102	876160	58
876506	876564	876622	876680	876737	58
877083	877141	877198	877256	877314	58
877659	877717	877774	877832	877889	58
878234	878292	878349	878407	878464	57
878809	878866	878924	878981	879038	57
879383	879439	879497	879555	879612	57
879956	870013	880070	880127	880185	57
880528	880585	880642	886699	880756	57
881099	881156	881213	881270	881328	57
881670	881727	881784	881841	881898	57
882240	882297	882354	882411	882468	57
882809	882866	882923	882980	883036	57
883377	883434	883491	883548	883665	57

N	0	1	2	3	4
765	883661	883718	883775	883832	883888
766	884229	884285	884342	884399	884455
767	884795	884852	884909	884965	885022
768	885361	885418	885474	885531	885587
769	885926	885983	886039	886097	886155
770	886491	886547	886604	886660	886716
771	887054	887111	887167	887223	887280
772	887617	887673	887730	887786	887842
773	888179	888236	888292	888348	888404
774	888741	888797	888853	888909	888965
775	889302	889358	889414	889470	889526
776	889862	889918	889974	890030	890030
777	890421	890477	890533	890589	890644
778	890980	891035	891091	891147	891203
779	891537	891593	891649	891705	891760
780	892095	892150	892206	892262	892317
781	892651	892707	892762	892818	892873
782	893207	893252	893318	893373	893429
783	893762	893817	893873	893928	893984
784	894316	894371	894427	894482	894538
785	894870	894925	894980	895036	895091
786	895422	895478	895533	895588	895643
787	895975	896030	896085	896140	896195
788	896526	896581	896636	896691	896747
789	897077	897132	897187	897242	897297
790	897672	897682	897737	897792	897847
791	898176	898231	898286	898341	898396
792	898725	898780	898835	898890	898944
793	899273	899328	899383	899437	899492
794	899820	899875	899930	899985	900039
795	900367	900422	900476	900531	900586
796	900913	900968	901022	901077	901131
797	901458	901513	901567	901622	901676
798	902003	902057	902112	902166	902220
799	902547	902601	902655	902710	902764

5	6	7	8	9	D
883945	884002	884059	884115	884172	57
884512	884569	884625	884682	884739	57
885078	885135	885191	885248	885305	57
885644	885700	885757	885813	885870	57
886209	886265	886321	886378	886434	57
886773	886829	886885	886941	886998	56
887336	887392	887449	887505	887561	56
887898	887955	888011	888067	888123	56
888460	888516	888573	888629	888685	56
889021	889077	889133	889190	889246	56
889582	889638	889694	889750	889806	56
890141	890197	890253	890309	890365	56
890700	890756	890812	890868	890924	56
891259	891314	891370	891425	891482	56
891816	891872	891928	891983	892039	56
892373	892428	892484	892540	892595	56
892929	892985	893040	893096	893151	56
893484	893540	893595	893651	893706	56
894039	894094	894150	894205	894261	55
894593	894648	894704	894759	894814	55
895146	895201	895257	895312	895367	55
895699	895754	895809	895864	895919	55
896251	896306	896361	896416	896471	55
896802	896857	896912	896967	897022	55
897352	897407	897462	897517	897572	55
897902	897957	898011	898067	898122	55
898451	898506	898561	898615	898670	55
898999	899054	899109	899164	899218	55
899547	899602	899656	899711	899766	55
900094	900149	900103	900258	900312	55
900640	900695	900749	900804	900858	55
901186	901240	901295	901349	901404	55
901731	901785	901840	901894	901948	54
902275	902329	902384	902438	902492	54
902818	902873	902927	902981	903036	54

N	0	1	2	3	4
800	903090	903144	903198	903253	903307
801	903632	903687	903741	903795	903849
802	904174	904228	904283	904337	904391
803	904715	904770	904824	904878	904932
804	905256	905310	905364	905418	905472
805	905796	905850	905904	905958	906012
806	906335	906389	906443	906497	906550
807	906873	906927	907981	907035	907089
808	907411	907465	907519	907573	907626
809	907648	908002	908056	908109	908163
810	908485	908539	908592	908646	908699
811	909021	909074	909128	909181	909235
812	909556	909609	909663	909716	909770
813	910090	910144	910197	910251	910304
814	910624	910678	910731	910784	910838
815	911158	911211	911264	911317	911371
816	911690	911743	911797	911850	911903
817	912223	912275	912328	912381	912435
818	912753	912806	912859	912912	912966
819	913284	913337	913390	913443	913496
820	913814	913867	913920	913973	914026
821	914343	914396	914449	914502	914555
822	914872	914925	914977	915030	915583
823	915400	915453	915505	915558	915611
824	915927	915980	916032	916085	916138
825	916454	916507	916559	916612	916664
826	916980	917033	917085	917138	917190
827	917565	917558	917611	917663	917715
828	918030	918083	918135	918188	918240
829	918554	918607	918659	918712	918764
830	919078	919130	919183	919235	919287
831	919601	919653	919700	919758	919810
832	920123	920175	920228	920280	920332
833	920645	920697	920742	920801	920853
834	921666	921218	921270	721322	921374

5	6	7	8	9	D
903361	903516	903470	903524	903578	54
903903	903958	904012	904066	904120	54
904445	904499	904553	904607	904661	54
904986	905040	905094	905148	905202	54
905526	905580	905634	905688	905742	54
906065	906119	906173	906227	906281	54
906604	906658	906712	906766	906820	54
907142	907196	907250	907304	907358	54
907680	907734	907787	907841	907895	54
908217	908270	908324	908378	908431	54
908753	908807	908860	908914	908967	54
909288	909342	909395	909449	909502	54
909823	909877	909930	909984	910037	53
910357	910411	910464	910518	910571	53
910891	910944	910998	911051	911104	53
911424	911477	911530	911584	911637	53
911956	912009	912062	912116	912169	53
912488	912541	912594	912647	912700	53
913019	913072	913125	913178	913231	53
913549	913602	913655	913708	913761	53
914079	914132	914184	911584	914290	53
914608	914660	914713	912116	914819	53
915136	915189	915241	912647	915347	53
915664	915716	915769	913178	915874	53
916191	916243	916296	913708	916401	53
916717	916770	916822	916875	916927	53
917243	917295	917348	917400	917453	53
917768	917820	917873	917925	917978	52
918292	918345	918397	918459	918502	52
918816	918869	918921	918973	919026	52
919340	919392	919444	919496	919549	52
919862	919914	919967	920029	920071	52
920384	920436	920489	920541	920593	52
920906	920958	921010	921062	921114	52
921426	921478	921530	921582	921634	52

N	0	1	2	3	4
835	921686	921738	921790	921842	921894
836	922206	922258	922310	922362	922414
837	922725	922777	922829	922881	922933
838	923244	923296	923348	923399	923451
839	923762	923814	923865	923917	923969
840	924279	924331	924383	924434	924486
841	924796	924848	924899	924951	925002
842	925312	925364	925415	925467	925518
843	925828	925879	925931	925982	926034
844	926342	926394	926445	926497	926548
845	926857	926908	926959	927011	927062
846	927370	927422	927473	927524	927576
847	927883	927935	927986	928037	928088
848	928396	928447	928498	928549	928601
849	928908	928959	929010	929061	929112
850	929419	929470	929521	929572	929623
851	929930	929981	930032	930083	930134
852	930440	930491	930541	930592	930643
853	930949	931000	931051	931102	931153
854	932458	931509	931560	931610	931661
855	931966	932017	932068	932118	932169
856	932474	932524	932575	932624	932677
857	932981	933031	933082	933131	933183
858	933487	933538	933588	933639	933690
859	933993	934044	934094	934145	934195
860	934498	934549	934599	934650	934700
861	935003	935054	935104	935154	935205
862	936507	933558	933608	935658	935709
863	936011	936061	936111	936162	936212
864	936514	936564	936614	936665	936715
865	937016	937066	937116	937167	937217
866	937518	937568	937618	937668	937718
867	938019	938069	938119	938169	938219
868	938520	938570	938620	938670	938720
869	939020	939070	939120	939170	939220

5	6	7	8	9	D
921946	921998	922050	922102	922154	52
922466	922518	922570	922622	922674	52
922985	923037	923088	923140	923192	52
923503	923555	923607	923658	923710	52
924022	924072	924124	924176	924228	52
924538	924589	924641	924693	924744	52
923054	925106	925157	925209	925261	52
925570	925621	925673	925725	925776	52
926085	926137	926188	926239	926291	51
926600	926651	926702	926754	926805	51
927114	927165	927216	927268	927319	51
927627	927678	927730	927781	927832	51
928140	938191	928242	928293	928345	51
928652	928703	928754	928805	928856	51
929163	929214	929266	929317	929368	51
929674	929725	929776	929827	929878	51
930185	930236	930287	930338	930389	51
930694	930745	930796	930847	930898	51
931203	931254	931305	931356	931407	51
931712	931763	931814	931864	931915	51
932220	932271	932322	932372	932423	51
932727	932778	932829	932879	932930	51
933234	933285	933335	933386	933437	51
933740	933791	933841	933892	933943	51
934256	934296	934347	934397	934448	51
934751	934801	934852	934902	934953	50
935255	935306	935356	935406	935457	50
935759	935809	935860	935910	935960	50
936262	936313	936363	936413	936463	50
936765	936815	936865	936916	936966	50
937267	937317	937367	937418	937468	50
937769	937819	937869	937919	937969	50
938269	938319	938370	938420	938469	50
938770	938820	938870	938920	938970	50
939270	939320	939370	939420	939470	50

N	0	1	2	3	4
870	939519	939569	939619	939668	939719
871	940018	940068	940188	940168	940218
872	940516	940566	940616	940666	940716
873	941014	941064	941114	941663	941213
874	941511	941561	941611	941660	941710
875	942008	942058	942107	942157	942206
876	942504	942554	942603	942653	942702
877	943000	943049	943099	943148	943198
878	943494	943544	943593	943643	943692
879	943989	944028	944088	944127	944186
880	944483	944532	944581	944631	944680
881	944976	945025	945074	945124	945173
882	945469	945518	945567	945616	945665
883	945961	946010	946059	946108	946157
884	946452	946501	946551	946600	946649
885	946943	946992	947041	947090	947139
886	947434	947483	947532	947581	947630
887	947924	947973	948022	948070	948119
888	948413	948462	948511	948560	948609
889	948902	948951	948999	949048	949097
890	949390	949439	949488	949536	949585
891	949878	949926	949975	950024	950073
892	950365	950414	950462	950511	950566
893	950851	950900	950949	950997	951046
894	951337	951386	951435	951483	951532
895	951823	951872	951920	951969	952017
896	952308	952356	952405	952453	952502
897	952792	952841	952889	952938	952986
898	953276	953325	953373	953421	953470
899	953760	953808	953856	953905	953953
900	954242	954291	954339	954387	954435
901	954725	954773	954821	954869	954918
902	955207	955255	955303	955351	955399
903	955688	955736	955784	955832	955880
904	956168	956216	956264	956313	956361

5	6	7	8	9	D
939769	939818	939868	939918	939968	50
940267	940317	940367	940417	940467	50
940765	940815	940865	940915	940964	50
941263	941313	941362	941412	941462	50
941760	941809	941859	941909	941958	50
942256	942306	942355	942405	942454	50
942752	942801	942851	942900	942950	50
943247	943297	943346	943396	943445	49
943742	943721	943841	943890	943639	49
944236	944285	944335	944384	944433	49
944729	944779	944828	944877	944927	49
945222	945272	945321	945370	945419	49
945715	945764	945813	945862	945911	49
946207	946256	946305	946354	946403	49
946698	946747	946796	946845	946894	49
947189	947238	947287	947336	947385	49
947679	947728	947777	947826	947875	49
948168	948217	948266	948315	948364	49
948657	948706	948755	948804	948853	49
949146	949195	949245	949292	949341	49
949634	949683	949731	949780	949829	49
950121	950170	950219	950267	950316	49
950608	950657	950706	950754	950803	49
951095	951143	951192	951240	951289	49
951580	951629	951677	951729	951775	49
952066	952114	952163	952211	952259	49
952550	952599	952647	952696	952744	48
953034	953083	953131	953180	953228	48
953518	953566	953615	953663	953711	48
954001	954049	954098	954146	954194	48
954484	954532	954580	954628	954977	48
954966	955214	955062	955110	955158	48
955447	955495	955543	955591	955640	48
955928	956976	956024	956072	956120	48
956409	956457	956505	956553	956601	48

N	0	1	2	3	4
905	956649	956697	956745	956793	956840
906	957128	957176	957224	957272	957320
907	957607	957655	957703	957751	957799
908	958086	958134	958181	958229	958277
909	958564	958612	958659	958707	958755
910	959041	959089	959137	959184	959232
911	959518	959566	959614	959661	959709
912	959995	960042	960090	960138	960185
913	960471	960518	960566	960613	960661
914	960946	960994	961041	961089	961136
915	961421	961468	961516	961563	961611
916	961895	961943	961990	962038	962085
917	962369	962417	962464	962511	962559
918	962843	962890	962937	962985	963032
919	963315	963363	963410	963457	963504
920	963788	963835	963882	963929	963977
921	964260	964307	964354	964401	964448
922	964731	964778	964825	964872	964919
923	965202	965246	965296	965343	965390
924	965672	965719	965766	965813	965860
925	965142	966189	966236	966283	966329
926	966611	966658	966705	966752	966798
927	967080	967127	967173	967220	967267
928	967548	967595	967642	967688	967735
929	968016	968062	968109	968156	968202
930	968481	968530	968576	968623	968670
931	968950	968996	969043	969090	969136
932	969416	969463	969509	969556	969602
933	969882	969928	969975	970021	970068
934	970347	970393	970440	970486	970533
935	970812	970858	970904	970951	970997
936	971276	971322	971369	971415	971461
937	971740	971786	971832	971879	971925
938	972203	972249	972295	972342	972388
939	972666	972712	972578	972804	972851

5	6	7	8	9	D
56888	956936	956984	957032	957080	48
57368	957416	957464	957512	957559	48
57847	957894	957942	957990	958038	48
58325	958373	958421	958468	958516	48
58803	958850	958898	958946	958994	48
959280	959328	959375	959423	959471	48
959757	959804	959852	959900	959947	48
960233	960280	960328	960376	960423	48
960709	960756	960804	960851	960899	48
961184	961231	961279	961326	961374	47
961658	961706	961753	961801	961848	47
962132	962180	962227	962275	962322	47
962606	962653	962701	962748	962795	47
963079	963126	963174	963221	963268	47
963552	963599	963646	963693	963741	47
964024	964071	964118	964165	964212	47
964495	964542	964590	964637	964684	47
964966	965013	965061	965108	965155	47
965437	965484	965531	965578	965624	47
965907	965954	966001	966048	966095	47
966376	966423	966470	966517	966564	47
966845	966892	966939	966986	967033	47
967314	967361	967408	967454	967501	47
967782	967829	967875	967922	967969	47
968249	968296	968343	968389	968436	47
968716	968763	968810	968856	968903	47
969183	969229	969276	969323	969369	47
969649	969695	969742	969789	969835	47
970114	970161	970207	970254	970300	47
970579	970626	970672	970719	970765	46
971044	971090	971137	971183	971229	46
971508	971554	971601	971647	971693	46
971971	972018	972064	972110	972157	46
972434	972481	972527	972573	972619	46
972897	972943	972989	973035	973082	46

N	0	1	2	3	4
940	973128	973174	973220	973266	973313
941	973590	973636	973682	973728	973774
942	974051	974097	974143	974189	974235
943	974512	974558	974604	974650	974696
944	974972	975018	975064	975110	975156
945	975432	975478	975524	975570	975616
946	975891	975937	975983	976029	976075
947	976350	976396	976442	976488	976533
948	976828	976854	976899	976946	976992
949	977266	977312	977358	977403	977449
950	977714	977769	977815	977861	977906
951	978181	978226	978272	978317	978363
952	978637	978683	978728	978774	978819
953	979093	979138	979184	979230	979275
954	979548	979594	979639	979685	979730
955	980003	980049	980094	980140	980185
956	980458	980503	980539	980594	980640
957	980912	980957	981003	981048	981093
958	981366	981411	981456	981501	981547
959	981819	981864	981909	981954	982000
960	982271	982316	982362	982407	982452
961	982723	982769	982814	982859	982904
962	983175	983220	983265	983310	983356
963	983626	983671	983716	983762	983807
964	984077	984122	983167	984212	984257
965	984527	984572	984617	984662	984707
966	984977	985022	985067	985112	985157
967	985426	985471	985516	985561	985606
968	985875	985920	985965	986010	986055
969	986324	986369	986413	986458	986503
970	986772	986816	986861	986906	986951
971	987219	987264	987309	987353	987398
972	987666	987711	987756	987800	987845
973	988113	988157	988202	988247	988291
974	988559	988604	988648	988693	988737

5	6	7	8	9	D
973359	973405	973451	973497	973543	46
973820	973866	973913	973959	974005	46
974281	974327	974374	974420	974466	46
974742	974788	974834	974880	974926	46
975202	975248	975294	975340	975386	46
975662	975707	975753	975799	975845	46
976121	976167	976212	976258	976304	46
976579	976625	976671	976717	976763	46
977037	977083	977129	977175	977220	46
977495	977541	977586	977632	977678	46
977952	977998	978043	978089	978135	46
978409	978454	978500	978546	978591	46
978865	978911	978956	979002	979047	46
979321	979366	979412	979457	979503	46
979776	979821	979867	979912	979958	46
980231	980276	980322	980367	980412	45
980685	980730	980776	980821	980867	45
981139	981184	981229	981275	981320	45
981592	981637	981683	981728	981773	45
982045	982090	982135	982181	982226	45
982497	982543	982588	982633	982678	45
982949	982994	983040	983085	983130	45
983401	983446	983491	983536	983581	45
983852	983897	983942	983987	984032	45
984302	984347	984392	984437	984482	45
984752	984797	984842	984887	984932	45
985202	985247	985292	985337	985382	45
985651	985696	985741	985786	985830	45
986100	986144	986189	986234	986279	45
986548	986593	986637	986682	986727	45
986996	987040	987085	987130	987175	45
987443	987488	987532	987577	987622	45
987890	987934	987979	988024	988068	45
988336	988381	988425	988470	988514	45
988782	988826	988871	988916	988960	45

N	0	1	2	3	4
975	989005	989049	989094	989138	989183
976	989450	989494	989539	989583	989628
977	989895	989939	989983	990028	990072
978	990339	990383	990428	990472	990516
979	990783	990827	990871	990916	990960
980	991226	991270	991315	991359	991403
981	991669	991713	991757	991802	991845
982	992111	992156	992200	992244	992288
983	992554	992598	992642	992686	992730
984	992995	993039	993083	993127	993172
985	993436	993480	993524	993568	993613
986	993877	993921	993965	994009	994053
987	994317	994361	994405	994449	994493
988	994757	994801	994845	994889	994933
989	995196	995240	995284	995328	995372
990	995635	995679	995723	995767	995811
991	996074	996117	996161	996205	996249
992	996512	996555	996599	996643	996687
993	996949	996993	997037	997080	997124
994	997386	997430	997474	997517	997561
995	997823	997867	997910	997954	997998
996	998259	998303	998346	998390	998434
997	998695	998739	998782	998826	998869
998	999130	999174	999218	999261	999305
999	999565	999609	999652	999696	999739

End of the Table

5	6	7	8	9	D
989227	989272	989316	989361	989405	45
989672	989717	989761	989806	989850	44
990117	990161	990206	990250	990294	44
990561	990605	990650	990694	990738	44
991004	991049	991093	991137	991182	44
991448	991492	991536	991580	991625	44
991890	991934	991979	992023	992067	44
992333	992377	992421	992465	992509	44
992774	992819	992863	992907	992951	44
993216	993260	993304	993348	993392	44
993657	993701	993745	993789	993833	44
994097	994141	994185	994229	994273	44
994537	994581	994625	994669	994713	44
994977	995021	995065	995108	995152	44
995416	995460	995504	995547	995591	44
995854	995898	995942	995986	996030	44
996293	996337	996380	996424	996468	44
996731	996774	996818	996862	996906	44
997168	997212	997255	997299	997343	44
997695	997648	997692	997736	997779	44
998041	998085	998129	998172	998216	44
998477	998521	998564	998608	998652	44
998913	998956	999000	999043	999087	44
999438	999392	999435	999479	999522	44
999783	999826	999870	999913	999956	43

Of Logarithms.

Here followeth

A TABLE

OF

PARTS PROPORTIONAL,

FOR

The finding the Logarithms of all Numbers betwixt 10000 and 100000.

Parts Proportional.

D	1	2	3	4	5	6	7	8	9
43	4	8	12	17	21	25	30	34	38
44	4	8	13	17	22	26	30	35	39
45	4	9	13	18	22	27	31	36	40
46	4	9	13	18	23	27	32	36	41
47	4	9	14	18	23	28	32	37	42
48	4	9	14	19	24	28	33	38	43
49	4	9	14	19	24	29	34	39	44
50	5	10	15	20	25	30	35	40	45
51	5	10	15	20	25	30	35	40	45
52	5	10	15	20	26	31	36	41	46
53	5	10	15	21	26	31	37	42	47
54	5	10	16	21	27	32	37	43	48
55	5	11	16	22	27	33	38	44	49
56	5	11	16	22	28	33	39	44	50
57	5	11	17	22	28	34	39	45	51
58	5	11	17	23	29	34	40	46	52
59	5	11	17	23	29	35	41	47	53
60	6	12	18	24	30	36	42	48	54
61	6	12	18	24	30	36	42	48	54
62	6	12	18	24	31	37	43	49	55
63	6	12	18	25	31	37	44	50	56
64	6	12	19	25	32	38	44	51	57
65	6	13	19	26	32	39	45	52	58
66	6	13	19	26	33	39	46	52	59
67	6	13	20	26	33	40	46	53	60
68	6	13	20	27	34	40	47	54	61
69	6	13	20	27	34	41	48	55	62
70	7	14	21	28	35	42	49	56	63
71	7	14	21	28	35	42	49	56	63
72	7	14	21	28	36	43	50	57	64
73	7	14	21	29	36	43	51	58	65
74	7	14	22	29	37	44	51	59	66
75	7	15	22	30	37	45	52	60	67
76	7	15	22	30	38	45	53	60	68

D	1	2	3	4	5	6	7	8	9
77	7	15	23	30	38	46	53	61	69
78	7	15	23	31	39	46	54	62	70
79	7	15	23	31	39	47	55	63	71
80	8	16	24	32	40	48	56	64	72
81	8	16	24	32	40	48	56	64	72
82	8	16	24	32	41	49	57	65	73
83	8	16	24	33	41	49	58	66	74
84	8	16	25	33	42	50	58	67	75
85	8	17	25	34	42	51	59	68	76
86	8	17	25	24	43	51	60	68	77
87	8	17	26	34	43	52	60	69	78
88	8	17	26	35	44	52	61	70	79
89	8	17	26	35	44	53	62	71	80
90	9	18	27	36	45	54	63	71	81
91	9	18	27	36	45	54	63	72	81
92	9	18	27	36	46	55	64	73	82
93	9	18	27	37	46	55	65	74	83
94	9	18	28	37	47	56	65	75	84
95	9	19	28	38	47	57	66	76	85
96	9	19	28	38	48	57	67	76	86
97	9	19	29	38	48	58	67	77	87
98	9	19	29	39	49	58	68	78	88
99	9	19	29	39	49	59	69	79	89
100	10	20	30	40	50	60	70	80	90
101	10	20	30	40	50	60	70	80	90
102	10	20	30	40	51	61	71	81	91
103	10	20	30	41	51	61	72	82	92
104	10	20	31	41	52	62	72	83	93
105	10	21	31	42	52	63	73	84	94
106	10	21	31	42	53	63	74	84	95
107	10	21	32	42	53	64	74	85	96
108	10	21	32	43	54	64	75	86	97
109	10	21	32	43	54	65	76	87	98
110	11	22	33	44	55	66	77	88	99

D	1	2	3	4	5	6	7	8	9
111	11	22	33	44	55	66	77	88	99
112	11	22	33	44	56	67	78	89	100
113	11	22	33	45	57	67	78	90	101
114	11	22	34	45	57	68	79	91	102
115	11	23	34	46	57	69	80	92	103
116	11	23	34	46	58	69	81	92	104
117	11	23	35	46	58	70	81	93	105
118	11	23	35	47	59	70	82	94	106
119	11	23	35	47	59	71	83	95	107
120	12	24	36	48	60	72	84	96	108
121	12	24	36	48	60	72	84	96	108
122	12	24	36	48	61	73	85	97	109
123	12	24	36	48	61	73	86	98	110
124	12	24	37	49	62	74	86	99	111
125	12	25	37	50	62	75	87	100	112
126	12	25	37	50	63	75	88	100	113
127	12	25	38	50	63	76	88	101	114
128	12	25	38	51	64	76	89	102	115
129	12	25	38	51	64	77	90	103	116
130	13	26	39	52	65	78	91	104	117
131	13	26	39	52	65	78	91	104	117
132	13	26	39	52	66	79	92	105	118
133	13	26	39	53	66	79	93	106	119
134	13	26	40	53	67	80	93	107	120
135	13	27	40	54	67	81	94	108	121
136	13	27	40	54	68	81	95	108	122
137	13	27	41	54	68	82	95	109	123
138	13	27	41	55	69	82	96	110	124
139	13	27	41	55	69	83	97	111	125
140	14	28	42	56	70	84	98	112	126
141	14	28	42	56	70	84	98	112	126
142	14	28	42	56	71	85	99	113	127
143	14	28	42	57	71	85	100	114	128
144	14	28	43	57	72	86	100	115	129

Parts Proportional.

D	1	2	3	4	5	6	7	8	9
145	14	28	43	58	72	87	101	116	130
146	14	29	43	58	73	87	102	116	131
147	14	29	44	58	73	88	102	117	132
148	14	29	44	59	74	88	103	118	133
149	14	29	44	59	74	89	104	119	134
150	15	30	45	60	75	90	105	120	135
151	15	30	45	60	75	90	105	120	135
152	15	30	45	60	76	91	106	121	136
153	15	30	45	60	76	91	107	122	137
154	15	30	46	61	77	92	107	123	138
155	15	31	46	62	77	93	108	124	138
156	15	31	46	62	78	93	109	124	140
157	15	31	47	62	78	94	109	125	141
158	15	31	47	63	79	94	110	126	142
159	15	31	47	63	79	95	111	127	143
160	16	32	48	64	80	96	112	128	144
161	16	32	48	64	80	96	112	128	144
162	16	32	48	64	81	97	113	129	145
163	16	32	48	65	82	98	114	130	146
164	16	32	49	66	82	98	114	131	147
165	16	33	49	66	82	99	115	132	148
166	16	33	49	66	83	99	116	132	149
167	16	33	50	66	83	100	116	133	150
168	16	33	50	67	84	100	117	134	151
169	16	33	50	67	84	101	118	135	152
170	17	34	51	68	85	102	119	136	153
171	17	34	51	68	85	102	119	136	153
172	17	34	51	68	86	103	120	137	154
173	17	34	51	69	86	103	121	138	155
174	17	34	52	69	87	104	121	139	156
175	17	34	52	70	87	105	122	140	157
176	17	35	52	70	88	105	123	140	158
177	17	35	53	70	88	106	123	141	159
178	17	35	53	71	89	106	124	142	160

Parts Proportional.

D	1	2	3	4	5	6	7	8	9
179	17	35	53	71	89	107	125	143	161
180	18	36	54	72	90	108	126	144	162
181	18	36	54	72	90	108	126	144	162
182	18	36	54	72	91	109	127	145	163
183	18	36	54	73	91	109	128	146	164
184	18	36	55	73	92	110	128	147	165
185	18	37	55	74	92	111	129	148	166
186	18	37	55	74	93	111	130	148	167
187	18	37	56	74	93	112	130	149	168
188	18	37	56	75	94	112	131	150	169
189	18	37	56	75	94	113	132	151	170
190	19	38	57	76	95	114	133	152	171
191	19	38	57	76	95	114	133	152	171
192	19	38	57	76	96	115	134	153	172
193	19	38	57	77	96	115	135	154	173
194	19	38	58	77	97	116	135	155	174
195	19	39	58	78	97	117	136	156	175
196	19	39	59	78	98	117	136	156	176
197	19	39	59	78	98	118	137	157	177
198	19	39	59	79	99	118	138	158	178
199	19	39	59	79	99	119	139	159	179
200	20	40	60	80	100	120	140	160	180
201	20	40	60	80	100	120	140	160	180
202	20	40	60	80	101	121	141	161	181
203	20	40	60	81	101	121	142	162	182
204	20	40	61	81	102	122	142	163	183
205	20	41	61	82	102	123	143	164	184
206	20	41	61	82	103	123	144	164	185
207	20	41	62	82	103	124	144	165	186
208	20	41	62	83	104	124	145	166	187
209	20	41	62	83	104	225	146	167	188
210	21	42	63	84	105	126	147	168	189
211	21	42	63	84	105	126	147	168	189
212	21	42	63	84	106	127	148	169	190

D	1	2	3	4	5	6	7	8	9
213	21	42	63	85	106	127	149	170	191
214	21	42	64	85	107	128	149	171	192
215	21	43	64	86	107	129	150	172	193
216	21	43	64	86	108	129	151	172	194
217	21	43	65	86	108	130	151	173	195
218	21	43	65	87	109	130	152	174	196
219	21	43	65	87	109	131	153	175	197
220	22	44	66	88	110	132	154	176	198
221	22	44	66	88	110	132	154	176	198
222	22	44	66	88	111	133	155	177	199
223	22	44	66	89	111	133	156	178	200
224	22	44	67	89	112	134	156	179	201
225	22	45	67	90	112	135	157	180	202
226	22	45	67	90	113	135	158	180	203
227	22	45	68	90	113	136	158	181	204
228	22	45	68	91	114	136	159	182	205
229	22	45	68	91	114	137	160	183	206
230	23	46	69	92	115	138	161	184	207
231	23	46	69	92	115	138	161	184	207
232	23	46	69	92	116	139	162	185	208
233	23	46	69	93	116	139	163	186	209
234	23	46	70	93	117	140	163	187	210
235	23	47	70	94	117	141	164	188	211
236	23	47	70	94	118	141	165	188	212
237	23	47	71	94	118	142	165	189	213
238	23	47	71	95	119	142	166	190	214
239	23	47	71	95	119	143	167	191	215
240	24	48	72	96	120	144	168	192	216
241	24	48	72	96	120	144	168	192	216
242	24	48	72	96	121	145	169	193	217
243	24	48	72	97	121	145	170	194	218
244	24	48	73	97	122	146	170	195	219
245	24	49	73	98	122	147	171	196	220
246	24	49	73	98	123	147	172	196	221

D	1	2	3	4	5	6	7	8	9
247	24	49	74	98	123	148	172	197	222
248	24	49	74	99	124	148	173	198	223
249	24	49	74	99	124	149	174	199	224
250	25	50	75	100	125	150	175	200	225
251	25	50	75	100	125	150	175	200	225
252	25	50	75	100	126	151	176	201	226
253	25	50	75	101	126	151	177	202	227
254	25	50	76	101	127	152	177	203	228
255	25	50	76	102	127	153	178	204	229
256	25	51	76	102	128	153	179	204	230
257	25	51	77	102	128	154	179	205	231
258	25	51	77	103	129	154	180	206	232
259	25	51	77	103	129	155	181	207	233
260	26	52	78	104	130	156	182	208	234
261	26	52	78	104	130	156	182	208	234
262	26	52	78	104	131	156	183	209	235
263	26	52	78	105	131	157	184	210	236
264	26	52	79	105	132	158	184	211	237
265	26	53	79	106	132	159	185	212	238
266	26	53	79	106	133	159	186	212	239
267	26	53	80	106	133	160	186	213	240
268	26	53	80	107	134	160	187	214	241
269	26	53	80	107	134	161	188	215	242
270	27	54	81	108	135	162	189	216	243
271	27	54	81	108	135	162	189	216	243
272	27	54	81	108	136	163	190	217	244
273	27	54	81	109	136	163	191	218	245
274	27	54	82	109	137	164	191	219	246
275	27	55	82	110	137	165	192	220	247
276	27	55	82	110	138	165	193	220	248
277	27	55	83	110	138	166	193	221	249
278	27	55	83	111	139	166	194	222	250
279	27	55	83	111	139	167	195	223	251
280	28	56	84	112	140	168	196	224	252

Parts Proportional.

D	1	2	3	4	5	6	7	8	9
281	28	56	84	112	140	168	196	224	252
282	28	56	84	112	141	169	197	225	253
283	28	56	84	113	141	169	198	226	254
284	28	56	85	113	142	170	198	227	255
285	28	57	85	114	142	171	199	228	256
286	28	57	85	114	143	171	200	228	257
287	28	57	86	114	143	172	200	229	258
288	28	57	86	115	144	172	201	230	259
289	28	57	86	115	144	173	202	231	260
290	29	58	87	116	145	174	203	232	261
291	29	58	87	116	145	174	203	232	261
292	29	58	87	116	146	175	204	233	262
293	29	58	87	117	146	175	205	234	263
294	29	58	88	117	147	176	205	235	264
295	29	59	88	118	147	177	206	236	265
296	29	59	88	118	148	177	207	236	266
297	29	59	88	118	148	178	207	237	267
298	29	59	89	119	149	178	208	238	268
299	29	59	89	119	149	179	209	239	269
300	30	60	90	120	150	180	210	240	270
301	30	60	90	120	150	180	210	240	270
302	30	60	90	120	151	181	211	241	271
303	30	60	90	121	151	181	212	242	272
304	30	60	91	121	152	182	212	243	273
305	30	61	91	122	152	183	213	244	274
306	30	61	91	122	153	183	214	244	275
307	30	61	92	122	153	184	214	245	276
308	30	61	92	123	154	184	215	246	277
309	30	61	92	123	154	185	216	247	278
310	31	62	93	124	155	186	217	248	279
311	31	62	93	124	155	186	217	248	279
312	31	62	93	124	156	187	218	249	280
313	31	62	93	125	156	187	219	250	281
314	31	62	94	125	157	188	219	251	282

Parts Proportional.

D	1	2	3	4	5	6	7	8	9
315	31	63	94	126	157	189	220	252	283
316	31	63	94	126	158	189	221	252	284
317	31	63	95	126	158	190	221	253	285
318	31	63	95	127	159	190	222	254	286
319	31	63	95	127	159	191	223	255	287
320	32	64	96	128	160	192	224	256	288
321	32	64	96	128	160	192	224	256	288
322	32	64	96	128	161	193	225	257	289
323	32	64	96	129	161	193	226	258	290
324	32	64	97	129	162	194	226	259	291
325	32	65	97	130	162	195	227	260	292
326	32	65	97	130	163	195	228	260	293
327	32	65	98	130	163	196	228	261	294
328	32	65	98	131	163	196	229	262	295
329	32	65	98	131	164	197	230	263	296
330	33	66	99	132	165	198	231	264	297
331	33	66	99	132	165	198	231	264	297
332	33	66	99	132	166	199	232	265	298
333	33	66	99	133	166	199	233	256	299
334	33	66	100	133	167	200	233	267	300
335	33	67	100	134	167	201	234	268	301
336	33	67	100	134	168	201	235	268	302
337	33	67	101	134	168	202	235	269	303
338	33	67	101	135	169	202	236	270	304
339	33	67	101	135	169	203	237	271	305
340	34	68	102	136	170	204	238	272	306
341	34	68	102	136	170	204	238	272	306
342	34	68	102	136	171	205	239	273	307
343	34	68	102	137	171	205	240	274	308
344	34	68	103	137	172	206	240	275	309
345	34	69	103	138	172	207	241	276	310
346	34	69	103	138	173	207	242	276	311
347	34	69	104	138	173	208	242	277	312
348	34	69	104	139	174	208	243	278	313

D	1	2	3	4	5	6	7	8	9
349	34	69	104	139	174	209	244	279	314
350	34	70	105	140	175	210	245	280	315
351	35	70	105	140	175	210	245	280	315
352	35	70	105	140	176	211	246	281	316
353	35	70	105	141	176	211	247	282	317
354	35	70	106	141	177	212	247	283	318
355	35	71	106	142	177	213	248	284	319
356	35	71	106	442	178	213	249	284	320
357	35	71	107	142	178	214	249	285	321
358	35	71	107	143	179	214	250	286	322
359	35	71	107	143	179	215	251	287	323
360	36	72	108	144	180	216	251	288	324
361	36	72	108	144	180	216	252	288	325
362	36	72	108	144	181	217	252	289	325
363	36	72	108	145	181	217	253	290	326
364	36	72	109	145	182	218	254	291	327
365	36	73	109	146	182	219	254	292	328
366	36	73	109	146	182	219	255	292	329
367	36	73	110	146	183	220	256	293	330
368	36	73	110	147	184	220	256	294	331
369	36	73	110	147	184	221	257	295	332
370	37	74	111	148	185	222	258	296	333
371	37	74	111	148	185	222	259	296	333
372	37	74	111	148	186	223	260	297	334
373	47	74	111	149	186	223	261	298	335
374	37	74	112	149	187	224	261	299	336
375	37	75	112	150	187	225	262	300	337
376	37	75	112	150	188	225	262	300	338
377	37	75	113	150	188	226	263	301	339
378	37	75	113	151	189	226	264	302	340
379	37	75	113	151	189	227	265	303	341
380	37	76	114	152	190	228	266	304	342
381	38	76	114	152	190	228	266	304	342
382	38	76	114	152	191	229	267	305	343

D	1	2	3	4	5	6	7	8	9
383	38	76	114	153	191	229	268	306	344
384	38	76	115	153	192	230	268	307	345
385	38	77	115	154	192	231	269	308	346
386	38	77	115	154	193	231	270	308	347
387	38	77	116	154	193	232	270	309	348
388	38	77	116	155	194	232	271	310	349
389	38	77	116	155	194	233	272	311	350
390	39	78	117	156	195	233	273	312	351
391	39	78	117	156	195	233	273	312	351
392	39	78	117	156	196	234	274	313	352
393	39	78	117	157	196	235	275	314	353
394	39	78	118	157	197	236	275	315	354
395	39	79	118	158	197	237	276	316	355
396	39	79	118	158	198	237	277	316	356
397	39	79	119	158	198	238	277	317	357
398	39	79	119	159	199	238	278	318	358
399	39	79	19	159	199	239	279	319	359
400	40	80	120	160	200	240	280	320	360
401	40	80	120	160	200	240	280	320	360
402	40	80	120	160	201	241	281	321	361
403	40	80	120	161	201	241	282	322	362
404	40	80	121	161	202	242	282	323	363
405	40	81	121	162	202	243	283	324	364
406	40	81	121	162	203	243	284	324	365
407	40	81	122	162	203	244	284	325	366
408	40	81	122	163	204	244	285	326	367
409	40	81	122	163	204	245	286	327	368
410	41	82	123	164	205	246	287	328	369
411	41	82	123	164	205	246	287	328	369
412	41	82	123	164	206	247	288	329	370
413	41	82	123	165	206	247	289	330	371
414	41	82	124	165	207	248	289	331	372
415	41	82	124	166	207	249	290	332	373
416	41	83	124	166	208	249	291	332	374

Parts Proportional.

D	1	2	3	4	5	6	7	8	9
417	41	83	125	166	208	250	291	333	375
418	41	83	125	167	209	250	292	334	376
419	41	83	125	167	209	251	293	335	377
420	42	84	126	168	210	252	294	336	378
421	42	84	126	168	210	252	294	336	378
422	42	84	126	168	211	253	295	337	379
423	42	84	126	169	211	253	295	338	380
424	42	84	127	169	212	254	296	339	381
425	42	85	127	170	212	255	297	340	382
426	42	85	127	170	213	255	298	340	383
427	42	85	128	170	213	256	298	341	384
428	42	85	128	171	214	256	299	342	385
429	42	85	128	171	214	257	300	343	386
430	43	86	129	172	215	258	301	344	387
431	43	86	129	172	215	258	301	344	387
432	43	86	129	172	216	259	302	345	388
433	43	86	129	173	216	259	303	346	389
434	43	86	130	173	217	260	304	347	390
435	43	87	130	174	217	261	304	348	391

A TABLE OF Artificial Sines AND TANGENTS, For every Degree and Minute OF THE QUADRANT, Fitted to the Size OF THE LOGARITHMS.

LONDON,
Printed for *Robert Harford* at the Angel in *Cornhil*, near the Royal Exchange. 1679.

Degree 0.

M	Sine	Co-sine	Tangent	Co-tang.	
0	0.000000	10.000000	0.000000	Infinita.	60
1	6.463726	9.999999	6.463726	13.536274	59
2	6.764756	9.999999	6.764756	13.235244	58
3	6.940847	9.999999	6.940847	13.059153	57
4	7.065786	9.999999	7.065786	12.934214	56
5	7.162696	9.999999	7.163696	12.837304	55
6	7.241877	9.999999	7.241878	12.758122	54
7	7.308824	9.999999	7.308825	12.691175	53
8	7.366816	9.999999	7.366817	12.633183	52
9	7.417968	9.999999	7.417970	12.582030	51
10	7.463726	9.999998	7.463727	12.536273	50
11	7.505118	9.999998	7.505120	12.494880	49
12	7.542906	9.999997	7.542909	12.457091	48
13	7.577668	9.999997	7.577272	12.422328	47
14	7.609853	9.999996	7.609857	12.390143	46
15	7.639816	9.999996	7.639826	12.360180	45
16	7.667844	9.999995	7.667849	12.332151	44
17	7.694173	9.999995	7.694179	12.305821	43
18	7.718977	9.999994	7.719003	12.281997	42
19	7.742477	9.999993	7.742484	12.257516	41
20	7.764754	9.999993	7.764761	12.235239	40
21	7.785943	9.999992	7.785951	12.214049	39
22	7.806146	9.999991	7.806145	12.193845	38
23	7.825451	9.999990	7.825460	12.174540	37
24	7.843934	9.999989	7.843944	12.156056	36
25	7.861662	9.999989	7.861674	12.138326	35
26	7.878695	9.999988	7.878708	12.121292	34
27	7.895085	9.999987	7.895099	12.104901	33
28	7.910879	9.999986	7.910894	12.089106	32
29	7.926219	9.999985	7.926134	12.073866	31
30	7.940842	9.899983	7.940858	12.059142	30
M	Co-sine	Sine	Co-tang.	Tangent	M

Degree 89.

Degree 0.

M	Sine	Co-sine	Tangent	Co-tang.	
30	7.940842	9.999983	7.940858	12.059142	30
31	7.955082	9.999982	7.955100	12.044900	29
32	7.968870	9.999981	7.968889	12.031111	28
33	7.982233	9.999980	7.982253	12.017747	27
34	7.995198	9.999978	7.995215	12.004781	26
35	8.007787	9.999978	7.007810	11.992191	25
36	8.020021	9.999976	8.020044	11.979956	24
37	8.031919	9.999975	8.031945	11.968055	23
38	8.043501	9.999973	8.043527	11.956473	22
39	8.054781	9.999972	8.054809	11.945181	21
40	8.065776	9.999971	8.065806	11.934194	20
41	8.076500	9.999969	8.076531	11.923469	19
42	8.086965	9.999968	8.086997	11.913003	18
43	8.097183	9.999966	8.097217	11.902783	17
44	8.107167	9.999964	8.107203	11.892797	16
45	8.116926	9.999963	8.116963	11.883037	15
46	8.126471	9.999961	8.126510	11.873490	14
47	8.135810	9.999959	8.135851	11.864149	13
48	8.144953	9.999958	8.144996	11.855004	12
49	8.153907	9.999956	8.153952	11.846048	11
50	8.162681	9.999954	8.162737	11.837273	10
51	8.171280	9.999952	8.171328	11.828672	9
52	8.179713	9.999950	8.179763	11.820237	8
53	8.187985	9.999948	8.188036	11.811964	7
54	8.196102	9.999946	8.196156	11.803844	6
55	8.204070	9.999944	8.204126	11.795874	5
56	8.211895	9.999942	8.211953	11.788047	4
57	8.219581	9.999940	8.219641	11.780359	3
58	8.227134	9.999938	8.227195	11.772805	2
59	8.234557	9.999936	8.234621	11.765379	1
60	8.241855	9.996934	8.241921	11.758079	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 89.

Degree 1.

M	Sine	*Co-sine*	Tangent	*Co-tang.*	
0	8.241855	9.999934	8.241921	11.758079	60
1	8 249033	9.999932	8.249102	11.750898	59
2	8.256094	9.999929	8.256165	11.743835	58
3	8.263042	9 999927	8.263115	11.736885	57
4	8.269881	9.999925	8.269956	11.730044	56
5	8.276614	9.999922	8.276691	11.723309	55
6	8.283243	9.999920	8.283323	11.716677	54
7	8.289773	9.999918	8.289856	11.716144	53
8	8.296207	9.999915	8.296292	11.703708	52
9	8.302546	9.999913	8.302634	11.697366	51
10	8.308794	9.999910	8 308884	11.691116	50
11	8.314954	9.999907	8.315046	11.684954	49
12	8.321027	9.999905	8.321122	11.678878	48
13	8.327016	9.999902	8.327114	11.672886	47
14	8.332924	9.999899	8.333025	11.666975	46
15	8:338753	9.999897	8 3388 56	11.661144	45
16	8.344504	9.999894	8.344610	11.655390	44
17	8.350180	9.999891	8.350289	11.649711	43
18	8.355783	9.999888	8.355895	11.644105	42
19	8.361315	9.999885	8.361430	11.638570	41
20	8.366777	9 999882	8.366895	11.633105	40
21	8.372171	9.999879	8.372292	11.627708	39
22	8.377499	9.999876	8.377622	11.622378	38
23	8.382762	9 999873	8.382889	11.617111	37
24	8.387962	9.999870	8.388092	11.611908	36
25	8.393101	9 999867	8.393234	11.606766	35
26	8.398179	9.999864	8.398315	11.601685	34
27	8.403199	9.999861	8.403338	11.596662	33
28	8.408161	9.999858	8.408304	11.591696	32
29	8.413068	9,999854	8.413213	11.586787	31
30	8.417919	9.999851	8.418068	11 581932	30
	Co-sine	Sine	*Co-tang.*	Tangent	M

Degree 88.

Degree 1.

M	Sine	*Co-sine*	Tangent	*Co-tang.*	
30	8.417919	9.999851	8.418068	11.581932	30
31	8.422717	9.999848	8.422869	11.577131	29
32	8.427462	9.999844	8.427618	11.572382	28
33	8.432156	9.999841	8.432315	11.567685	27
34	8.436800	9.999838	8.436962	11.563038	26
35	8.441394	9.999834	8.441560	11.558440	25
36	8.445941	9.999831	8.446110	11.553990	24
37	8.450440	9.999827	8.450613	11.549387	23
38	8.454892	9.999824	8.455070	11.544930	22
39	8.459301	9.999820	8.459481	11.540519	21
40	8.463665	9.999816	8.463849	11.536151	20
41	8.467985	9.999812	8.468172	11.531828	19
42	8.472263	9.999809	8.472454	11.527546	18
43	8.476498	9.999805	8.476693	11.523307	17
44	8.480693	9.999801	8.480892	11.519108	16
45	8.484848	9.999797	8.485050	11.514950	15
46	8.488963	9.999794	8.489170	11.510830	14
47	8.493040	9.999790	8.493250	11.506750	13
48	8.497078	9.999786	8.497293	11.502707	12
49	8.501080	9.999782	8.501298	11.498702	11
50	8.505045	9.999778	8.505267	11.494733	10
51	8.508974	9.999774	8.509200	11.490800	9
52	8.512867	9.999769	8.513098	11.486902	8
53	8.516726	9.999765	8.516961	11.483039	7
54	8.520551	9.999761	8.520790	11.479210	6
55	8.524343	9.999756	8.524586	11.475414	5
56	8.528102	9.999753	8.528349	11.471651	4
57	8.531828	9.999748	8.532080	11.467920	3
58	8.535523	9.999744	8.535779	11.464221	2
59	8.539186	9.999740	8.539447	11.460553	1
60	8.542819	9.999735	8.543084	11.456916	0
	Co-sine	Sine	*Co-tang.*	Tangent	M

Degree 88.

Degree 2.

M	Sine	Co-sine	Tangent	Co-tang.	
0	8.542819	9.999733	8.543084	11.456916	60
1	8.546422	9.999731	8.546691	11.453309	59
2	8.549995	9.999726	8.550268	11.449732	58
3	8.553558	9.999722	8.553817	11.446183	57
4	8.557054	9.999717	8.557336	11.442664	56
5	8.560540	9.999713	8.560827	11.439172	55
6	8.563999	9.999708	8.564291	11.435709	54
7	8.567431	9.999703	8.567727	11.432272	53
8	8.570836	9.999699	8.571137	11.428863	52
9	8.574214	9.999694	8.574520	11.425480	51
10	8.577566	9.999689	8.577877	11.422123	50
11	8.580892	9.999685	8.581208	11.418792	49
12	8.584193	9.999680	8.584514	11.415486	48
13	8.587469	9.999675	8.587795	11.412205	47
14	8.590721	9.999670	8.591051	11.408949	46
15	8.593948	9.999665	8.594283	11.405717	45
16	8.597152	9.999660	8.597492	11.402508	44
17	8.600332	9.999655	8.600677	11.399323	43
18	8.603488	9.999650	8.603838	11.396161	42
19	8.606622	9.999645	8.606978	11.393022	41
20	8.609734	9.999640	8.610094	11.389906	40
21	8.612823	9.999635	8.613189	11.386811	39
22	8.615891	9.999629	8.616262	11.383738	38
23	8.618937	9.999624	8.619313	11.380687	37
24	8.621967	9.999619	8.622343	11.377657	36
25	8.624965	9.999614	8.625352	11.374648	35
26	8.627948	9.999608	8.628340	11.371660	34
27	8.630911	9.999603	8.631308	11.368692	33
28	8.633854	9.999597	8.634456	11.365744	32
29	8.636776	9.999592	8.637184	11.362816	31
30	8.639679	9.999586	8.640093	11.359907	30
M	Co-sine	Sine	Co-tang.	Tangent	M

Degree 87.

Degree 2.

M	Sine	*Co-sine*	Tangent	*Co-Tang.*	
30	8.639679	9.999586	8.640093	11.359907	30
31	8.642563	9.999581	8.642982	11.357017	29
32	8.645428	9.999575	8.645853	11.354147	28
33	8.648274	9.999570	8.648704	11.351296	27
34	8.651102	9.999564	8.651538	11.348463	26
35	8.653911	9.999558	8.654352	11.345648	25
36	8.656702	9.999553	8.657149	11.342851	24
37	8.659475	9.999547	8.659928	11.340072	23
38	8.662230	9.999541	8.662689	11.337311	22
39	8.664968	9.999535	8.665433	11.334567	21
40	8.667689	9.999529	8.668160	11.331840	20
41	8.670393	9.999523	8.670869	11.329130	19
42	8.673080	9.999518	8.673563	11.326437	18
43	8.675751	9.999512	8.676239	11.323761	17
44	8.678405	9.999506	8.678899	11.321100	16
45	8.681043	9.999499	8.681544	11.318456	15
46	8.683665	9.999493	9.684172	11.315828	14
47	8.686272	9.999487	8.686784	11.313216	13
48	8.688862	9.999481	8.689381	11.310619	12
49	8.691438	9.999475	8.691963	11.308037	11
50	8.693998	9.999469	8.694529	11.305471	10
51	8.696543	9.999462	8.697081	11.302919	9
52	8.699073	9.999456	8.699617	11.300383	8
53	8.701589	9.999450	8.702139	11.297861	7
54	8.704090	9.999443	8.704646	11.295354	6
55	8.706576	9.999437	8.707139	11.292860	5
56	8.709049	9.999431	8.709618	11.290381	4
57	8.711507	9.999424	8.712083	11.287917	3
58	8.713952	9.999418	8.714543	11.285466	2
59	8.716383	9.999411	8.716972	11.283028	1
60	8.718800	9.999404	8.719396	11.280604	0
	Co-sine	Sine	*Co-tang.*	Tangent	M

Degree 87.

Degree 3.

M.	Sine	Co-sine	Tangent	Co-tang.	
0	8.718800	9.999404	8.719396	11.280604	60
1	8.721204	9.999398	8.721806	11.278194	59
2	8.723595	9.999391	8.724254	11.275796	58
3	8.725972	9.999384	8.726588	11.273412	57
4	8.728336	9.999378	8.728959	11.271041	56
5	8.730688	9.999371	8.731317	11.268683	55
6	8.733027	9.999364	8.733663	11.266337	54
7	8.735354	9.999357	8.735996	11.264004	53
8	8.737667	9.999350	8.738317	11.261683	52
9	8.739969	9.999343	8.740626	11.259374	51
10	8.742259	9.999336	8.742922	11.257078	50
11	8.744536	9.999329	8.745207	11.254793	49
12	8.746801	9.999322	8.747479	11.252521	48
13	8.745955	9.999315	8.749740	11.250240	47
14	8.751297	9.999308	8.751989	11.248011	46
15	8.753528	9.999301	8.754227	11.245773	45
16	8.755747	9.999294	8.756453	11.243547	44
17	8.757955	9.999286	8.758668	11.241332	43
18	8.760151	9.999279	8.760872	11.239128	42
19	8.762337	9.999272	8.763065	11.236935	41
20	8.764511	9.999265	8.765246	11.234754	40
21	8.766675	9.999257	8.767417	11.232583	39
22	8.768828	9.999250	8.769578	11.230422	38
23	8.770970	9.999242	8.771727	11.228273	37
24	8.773101	9.999235	8.773866	11.229134	36
25	8.775213	9.999227	8.775995	11.224005	35
26	8.777333	9.999220	8.778114	11.221886	34
27	8.779434	9.999212	8.783222	11.219778	33
28	8.781524	9.999204	8.782320	11.217680	32
29	8.783605	9.999197	8.784404	11.215592	31
30	8.785675	9.999189	8.786486	11.213514	30
	Co-sine	Sine	Co-tang.	Tangent	

Degree 86.

Degree 3.

M	Sine	Co-sine	Tangent	Co-tang.	
30	8.785675	9.999189	8.786486	11.213514	30
31	8.787736	9.999181	8.788554	11.211446	29
32	8.789787	9.999174	8.790613	11.209387	28
33	8.791828	9.999166	8.792662	11.207338	27
34	8.793859	9.999158	8.794701	11.205299	26
35	8.795881	9.999150	8.796731	11.203269	25
36	8.797894	6.999142	8.798752	11.201248	24
37	8.799897	9.999134	8.800763	11 199237	23
38	8.801891	9.999126	8.802765	11.197235	22
39	8.803876	9.999118	8.807458	11.195242	21
40	8.805852	9 999110	8.806742	11.193258	20
41	8.807819	9.999102	8.808717	11.191285	19
42	8.809777	9.999094	8.812683	11.189317	18
43	8.811726	9.999086	8.812641	11.187359	17
44	8 813667	9.999077	8.814589	11.185411	16
45	8.815598	9.999069	8.816529	11.183471	15
46	8.817522	9.999061	8.818461	11.181539	14
47	8.819436	9.999052	8.820384	11.179616	13
48	8.821342	9.999044	8.822298	11.177702	12
49	8.823240	9.999036	8.824205	11.175795	11
50	8.825130	9.999027	8.826103	11.173897	10
51	8.827011	9.999019	8.827992	11.172008	9
52	8.828884	9.999010	8.829874	11.170126	8
53	8 830749	9.999002	8.831748	11.168252	7
54	8.832106	9.998993	8.833613	11.166387	6
55	8.834456	9.998984	8.835471	11.164529	5
56	8.836297	9 998976	8.837321	11.162679	4
57	8.838130	9.998967	8.839163	11.160837	3
58	8.839956	9.998958	8.840998	11.159002	2
59	8.841774	9.998940	8.842825	11.157175	1
60	8.843585	9.998941	8.844644	11.155356	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 86.

Degree 4.

M	Sine	Co-sine	Tangent	Co-tang.	
0	8.843584	9.998941	8.844649	11.155356	60
1	8.845387	9.998931	8.846415	11.153515	59
2	8.847183	9.998923	8.848240	11.151740	58
3	8.848971	9.998914	8.850057	11.149943	57
4	8.850751	9.998905	8.851846	11.148154	56
5	8.852525	9.998896	8.853628	11.146372	55
6	8.854291	9.998887	8.855403	11.144597	54
7	8.856049	9.998878	8.857171	11.142829	53
8	8.857801	9.998869	8.858932	11.141068	52
9	8.859546	9.998860	8.860686	11.139314	51
10	8.861283	9.998851	8.862433	11.137567	50
11	8.863014	9.998841	8.864173	11.135827	49
12	8.864738	9.998832	8.865906	11.134094	48
13	8.866454	9.998823	8.867632	11.132368	47
14	8.868165	9.998813	8.869351	11.130649	46
15	8.869868	9.998804	8.871064	11.128936	45
16	8.871565	9.998795	8.872770	11.127230	44
17	8.873255	9.998785	8.874469	11.125531	43
18	8.874938	9.998776	8.876162	11.123838	42
19	8.876615	9.998766	8.877849	11.122151	41
20	8.878285	9.998757	8.879529	11.120471	40
21	8.879949	9.998747	8.881202	11.118798	39
22	8.881607	9.998738	8.882869	11.117131	38
23	8.883258	9.998728	8.884530	11.115470	37
24	8.884903	9.998718	8.886185	11.113815	36
25	8.886542	9.998708	8.887833	11.112167	35
26	8.888174	9.998699	8.889476	11.110524	34
27	8.889801	9.998689	8.891112	11.108888	33
28	8.891421	9.998679	8.892742	11.107258	32
29	8.893035	9.998669	8.894366	11.105634	31
30	8.894643	9.998659	8.895984	11.104016	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 85.

Degree 4.

M	Sine	Co-sine	Tangeur	Co-tang.	
30	8.894643	9.998659	8.895940	11.104016	30
31	8.896246	9.998649	8.897596	11.102404	29
32	8.897842	9.998639	8.899203	11 100797	28
33	8.899432	9.998629	8.900803	11.099197	27
34	8.901017	9.998619	8.902398	11.097602	26
35	8.902596	9.998609	8.903987	11.096013	25
36	8.904169	9.998599	8.905570	11.094430	24
37	8 905736	9.998589	8.907147	11.092853	23
38	8.907297	9.998577	8.908719	11.091281	22
39	8.908853	9.998568	8.910285	11.089715	21
40	8.910404	9.998558	8.911846	11.088154	20
41	8.911949	9.998548	8.913401	11.086599	19
42	8.913488	9.998537	8.914951	11.085049	18
43	8.915022	9.998527	8.916495	11.083505	17
44	8.916550	9.998516	8.918034	11.081960	16
45	8.918073	9.998506	8.919568	11.080432	15
46	8.919591	9.998495	8.921096	11.078924	14
47	8.921103	9.998485	8.922619	11.077331	13
48	8.922610	9.998474	8.924136	11.075864	12
49	8.924112	9.998464	8.925649	11.074351	11
50	8.925609	9.998453	8.927156	11 072844	10
1	8.927100	9.998442	8.928658	11.071344	9
2	8.928587	9.998431	8.930155	11.069845	8
3	8.930068	9.998421	8 931647	11.068353	7
4	8.931544	9.998410	8.933134	11.066866	6
5	8.933015	9.998399	8.934616	11.065384	5
6	8.934481	9.998388	8.936093	11.063907	4
7	8.935942	9 998377	8.937565	11.062435	3
8	8.937398	9.998366	8.939032	11.060968	2
9	8.938850	9.998255	8 940494	11.059506	1
10	8.940296	9.998344	8.941952	11.058048	0
	Co-sine	Sine	Co-tang.	Tangent	

Degree 85.

M

Degree 5.

M	Sine	Co-sine	Tangent	Co-tang.	
0	8.940296	9.998344	8 941952	11.058048	60
1	8.941738	9.998333	8.943404	11.056596	59
2	8.943174	9.998322	8.944852	11.055148	58
3	8 944606	9.998311	8.946295	11.053705	57
4	8.946034	9.998300	8.947734	11.052266	56
5	8.957456	9.998289	8.949168	11.050832	55
6	8 9588 14	9.998277	8.950597	11.049403	54
7	8.950287	9.998266	8.952021	11.047979	53
8	8.951696	9.998255	8.953441	11.046559	52
9	8.953099	9.998243	8.954856	11.045144	51
10	8.954499	9.998232	8.956267	11.0437 3	50
11	8.955804	9.998220	8.957674	11.042326	49
12	8.957284	9.998209	8 959075	11.040925	48
13	8.958670	9.998197	8.960473	11.039527	47
14	8.960052	9.998186	8.961866	11 038134	46
15	8.961429	9.998174	8.963254	11.036746	45
16	8.962801	9.998163	8.964639	11.035361	44
17	8.964170	9 998151	8.966019	11.033981	43
18	8.965534	9.998139	8.967394	11.032606	42
19	8.966893	9.998128	8.968766	11.031234	41
20	8.968249	9.998106	8.970133	11.029867	40
21	8.969600	9.998104	8.971495	11.028505	39
22	8.970947	9.998092	8.972855	11.027145	38
23	8.972289	9.998080	8.974209	11.025791	37
24	8.973626	9.998068	8.975560	11.024440	36
25	8.974962	9.998056	8.976906	11.023094	35
26	8.976293	9.998044	1.978248	11.021752	34
27	8.977619	9.998032	8 979586	11.020414	33
28	8.978941	9.998020	8.980921	11.019079	32
29	8.980259	9.998008	8.982251	11.017749	31
30	8.981573	9.997996	8.683577	11.016423	30
M	Co-sine	Sine	Co-tang.	Tangent	M

Degree 84.

Degree 5.

M	Sine	Co-sine	Tangent	Co-tang.	
30	8.981573	9.997996	8.983577	11.016423	30
31	8.982883	9.997984	8.984899	11.015101	29
32	8.984189	9.997971	8.986217	11.013783	28
33	8.985491	9.997959	8.987532	11.012468	27
34	8.986789	9.997947	8.988842	11.011158	26
35	8.988083	9.997935	8.990149	11.009851	25
36	8.989374	9.997922	8.991451	11.008549	24
37	8.990660	9.997910	8.992750	11.007250	23
38	8.991943	9.997897	8.994045	11.005955	22
39	8.993228	9.997885	8.995337	11.004663	21
40	8.994497	9.997873	8.996624	11.003376	20
41	8.995768	9.997860	8.997908	11.002092	19
42	8.997036	9.997847	8.999188	11.000812	18
43	8.998299	9.997835	9.000465	10.999535	17
44	8.999560	9.997822	9.001738	10.998262	16
45	8.900816	9.997809	9.003007	10.996993	15
46	9.002069	9.997797	9.004272	10.995728	14
47	9.003318	9.997784	9.005534	10.994466	13
48	9.004563	9.997771	9.006792	10.993208	12
49	9.005805	9.997758	9.008047	10.991953	11
50	9.007044	9.997742	9.009298	10.990702	10
51	9.008278	9.997732	9.010546	10.989454	9
52	9.009510	9.997719	9.011790	10.988210	8
53	9.010737	9.997706	9.013031	10.986969	7
54	9.011962	9.997693	9.014268	10.985732	6
55	9.013182	9.997680	9.015502	10.984498	5
56	9.014399	9.997667	9.016732	10.983268	4
57	9.015613	9.997654	9.017959	10.982041	3
58	9.016824	9.997641	9.019183	10.980817	2
59	9.018031	9.997628	9.020403	10.979597	1
60	9.019235	9.997614	9.021620	10.978380	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 84.

Degree 6.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.019235	9.997614	9.021620	10.978380	60
1	9.020435	9.997601	9.022834	10.977166	59
2	9.021632	9.997588	9.024044	10.975956	58
3	9.022825	9.997574	9.025251	10.974749	57
4	9.024016	9.997562	9.026455	10.973545	56
5	9.025203	9.997548	9.027655	10.972345	55
6	9.026386	9.997534	9.028852	10.971148	54
7	9.027567	9.997520	9.030046	10.969954	53
8	9.028744	9.997507	9.031237	10.968763	52
9	9.029918	9.997493	9.032425	10.967575	51
10	9.031089	9.997480	9.033609	10.966391	50
11	9.032257	9.997466	9.034791	10.965209	49
12	9.033421	9.997452	9.035969	10.964031	48
13	9.034582	9.997439	9.037144	10.962856	47
14	9.035741	9.997425	9.038316	10.961684	46
15	9.036896	9.997411	9.039485	10.960515	45
16	9.038048	9.997397	9.040651	10.959349	44
17	9.039197	9.997383	9.041813	10.958187	43
18	9.040342	9.997369	9.042973	10.957027	42
19	9.041485	9.997355	9.044130	10.955870	41
20	9.042625	9.997341	9.045284	10.954716	40
21	9.043762	9.997327	9.046434	10.953566	39
22	9.044895	9.997313	9.047582	10.952418	38
23	9.046026	9.997299	9.048727	10.951273	37
24	9.047154	9.997285	9.049869	10.950131	36
25	9.048279	9.997271	9.051008	10.948992	35
26	9.049400	9.997256	9.052144	10.947856	34
27	9.050519	9.997242	9.053277	10.946723	33
28	9.051635	9.997228	9.054408	10.945592	32
29	9.052749	9.997214	9.055535	10.944465	31
30	9.053859	9.997199	9.056660	10.943340	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 83.

Degree 6.

M	Sine	Co-sine	Tangent	Co-tang	
0	9.053859	9.997199	9.056660	10.943340	30
1	9.054966	9.997185	9.057781	10.942219	29
2	9.056071	9.997170	9.058900	10.941100	28
3	9.057172	9.997156	9.060016	10.939984	27
4	9.058271	9.997141	9.061130	10.938870	26
5	9.059367	9.997127	9.062240	10.937760	25
6	9.060460	9.997112	9.063348	10.936652	24
7	9.061551	9.997098	9.064453	10.935547	23
8	9.062638	9.997083	9.065556	10.934444	22
9	9.063723	9.997068	9.066655	10.933345	21
10	9.064806	9.997053	9.067752	10.932248	20
11	9.065885	9.997039	9.068847	10.931153	19
12	9.066962	9.997024	9.069938	10.930062	18
13	9.068036	9.997009	9.071027	10.928973	17
14	9.069107	9.996994	9.072113	10.927887	16
15	9.070176	9.996979	9.073197	10.926803	15
16	9.071242	9.996964	9.074278	10.925722	14
17	9.072306	9.996949	9.075356	10.924644	13
18	9.073366	9.996934	9.076432	10.923568	12
19	9.074424	9.996919	9.077505	10.922495	11
20	9.075480	9.996904	9.078576	10.921424	10
21	9.076523	9.996889	9.079644	10.920356	9
22	9.077583	9.996874	9.080710	10.919290	8
23	9.078631	9.996858	9.081773	10.918227	7
24	9.079676	9.996843	9.082833	10.917167	6
25	9.080719	9.996828	9.083891	10.916109	5
26	9.081759	9.996812	9.084947	10.915053	4
27	9.082797	9.996797	9.085999	10.914000	3
28	9.083832	9.996782	9.087050	10.912950	2
29	9.084864	9.996766	9.088098	10.911902	1
30	9.085894	9.996751	9.089144	10.910856	0
M	Co-sine	Sine	Co-ting.	Tangent	

Degree 83.

Degree 7.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.085894	9.996751	9.089144	10.910856	60
1	9.086922	9.996735	9.090187	10.909813	59
2	9.087947	9.996720	9.091228	10.908772	58
3	9.088970	9.996704	9.092266	10.907734	57
4	9.089990	9.996688	9.093302	10.906698	56
5	9.091008	9.996673	9.094336	10.905664	55
6	9.092024	9.996657	9.095367	10.904633	54
7	9.093037	9.996641	9.096395	10.903604	53
8	9.094047	9.996625	9.097422	10.902578	52
9	9.095056	9.996610	9.098446	10.901554	51
10	9.096062	9.996594	9.099468	10.900532	50
11	9.097065	9.996578	9.100487	10.899513	49
12	9.098066	9.996562	9.101504	10.898496	48
13	9.099065	9.996546	9.102519	10.897481	47
14	9.100062	9.996530	9.103532	10.896468	46
15	9.101056	9.996514	9.104542	10.895458	45
16	9.102048	9.996498	9.105550	10.894450	44
17	9.103037	9.996482	9.106556	10.893444	43
18	9.104025	9.996465	9.107559	10.892441	42
19	9.105010	9.996449	9.108560	10.891440	41
20	9.105992	9.996433	9.109559	10.890441	40
21	9.106973	9.996417	9.110556	10.889444	39
22	9.107951	9.996400	9.111551	10.888449	38
23	9.108927	9.996384	9.112543	10.887457	37
24	9.109901	9.996368	9.113533	10.886467	36
25	9.110873	9.996351	9.114521	10.885478	35
26	9.111842	9.996335	9.115507	10.884493	34
27	9.112809	9.996318	9.116491	10.883509	33
28	9.113774	9.996302	9.117472	10.882528	32
29	9.114737	9.996285	9.118452	10.881548	31
30	9.115698	9.996269	9.119429	10.880571	30
—	Co-sine	Sine	Co-tang.	Tangent	M

Degree 82.

Degree 7.

M	Sine	Co-sine	Tangent	Cot-ang.	
30	9.115698	9.996269	9.119427	10.880571	30
31	9.116656	9.996252	9.120404	10.879595	29
32	9.117612	9.996235	9.121377	10.878623	28
33	9.118567	9.996218	9.122348	10.877652	27
34	9.119519	9.996202	9.123317	10.876683	26
35	9.120469	9.996185	9.124284	10.875716	25
36	9.121417	9.996168	9.125248	10.874751	24
37	9.122362	9.996152	9.126211	10.873789	23
38	9.123306	9.996134	9.127172	10.872828	22
39	9.124248	9.996117	9.128130	10.871870	21
40	9.125187	9.996100	9.129087	10.870913	20
41	9.126125	9.996083	9.130041	10.869959	19
42	9.127060	9.996066	9.130994	10.869006	18
43	9.127993	9.996049	9.131944	10.868056	17
44	9.128925	9.996032	9.132893	10.867107	16
45	9.129854	9.996015	9.133839	10 866161	15
46	9.130781	9.995998	9.134784	10.865216	14
47	9.131706	9.995980	9.135726	10.864274	13
48	9.132630	9.995963	9.136666	10.863334	12
49	9.133551	9.995946	9.137605	10.862395	11
50	9.134470	9 995928	9.138542	10.861458	10
51	9.135387	9.995911	9.139476	10.860524	9
52	9.136303	9.995894	9.140409	10.859591	8
53	9.137216	9.995876	9.141340	10.858660	7
54	9.138127	9.995859	9.142269	10.857731	6
55	9.139037	9.995841	9,143196	10,856804	5
56	9.139944	9.995825	9.144121	10.855879	4
57	9.140850	9.995806	9.145044	10.854956	3
58	9.141754	9.995788	9.145965	10.854035	2
59	9.142655	9.995770	9.146885	10.853115	1
60	9.143555	9.995753	9.147803	10.852197	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 82.

Degree 8.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.143555	9.995703	9.147803	10.852197	60
1	9.144453	9.995735	9.148718	10.851282	59
2	9.145349	9.995717	9.149632	10.850368	58
3	9.146243	9.995699	9.150544	10.849456	57
4	9.147136	9.995681	9.151454	10.848545	56
5	9.148026	9.995664	9.152363	10.847637	55
6	9.148915	9.995646	9.153269	10.846731	54
7	9.149801	9.995628	9.154174	10.845825	53
8	9.150686	9.995610	9.155077	10.844923	52
9	9.151569	9.995591	9.155978	10.844022	51
10	9.152451	9.995573	9.156877	10.843123	50
11	9.153330	9.995555	9.157775	10.842225	49
12	9.154208	9.995537	9.158671	10.841329	48
13	9.155082	9.995519	9.159565	10.840435	47
14	9.155957	9.995501	9.160457	12.839543	46
15	9.156830	9.995482	9.161347	10.838653	45
16	9.157700	9.995464	9.162236	10.837764	44
17	9.158569	9.995446	9.163123	10.836877	43
18	9.159436	9.995427	9.164008	10.835992	42
19	9.160301	9.995409	9.164892	10.835108	41
20	9.161164	9.995390	9.165773	10.834226	40
21	9.162025	9.995372	9.166654	10.833346	39
22	9.162885	9.995353	9.167532	10.832468	38
23	9.163743	9.995334	9.168409	10.831591	37
24	9.164600	9.995316	9.169284	10.830716	36
25	9.165454	9.995297	9.170157	10.829843	35
26	9.166307	9.995278	9.171029	10.828971	34
27	9.167158	9.995260	9.171899	10.828101	33
28	9.168008	9.995241	9.172767	10.827233	32
29	9.168856	9.995222	9.173634	10.826366	31
30	9.169702	9.995203	9.174499	10.825501	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 81.

Degree 8.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.169702	9.995203	9.174499	10.825501	30
31	9.170546	9.995184	9.175362	10.824638	29
32	9.171389	9.995165	9.176224	10.823776	28
33	9.172230	9.995146	9.177084	10.822916	27
34	9.173070	9.995127	9.177942	10.822057	26
35	9.173908	9.995108	9.178799	10.821201	25
36	9.174744	9.995089	9.179655	10.820345	24
37	9.175578	9.995070	9.180508	10.819492	23
38	9.176411	9.995061	9.181360	10.818640	22
39	9.177242	9.995032	9.182211	10.817789	21
40	9.178072	9.995012	9.183060	10.816940	20
41	9.178900	9.994993	9.183907	10.816093	19
42	9.179726	9.994974	9.184752	10.815248	18
43	9.180551	9.994955	9.185597	10.814403	17
44	9.181374	9.994935	9.186439	10.813561	16
45	9.182196	9.994916	9.187280	10.812720	15
46	9.183016	9.994896	9.188120	10.811880	14
47	9.183834	9.994876	9.188957	10.811042	13
48	9.184651	9.994857	9.189794	10.810206	12
49	9.185466	9.994838	9.190629	10.809371	11
50	9.186280	9.994818	9.191462	10.808538	10
51	9.187092	9.994798	9.192294	10.807706	9
52	9.187903	9.994779	9.193124	10.806876	8
53	9.188712	9.994759	9.193953	10.806047	7
54	9.189519	9.994739	9.194780	10.805220	6
55	9.190325	9.994719	9.195606	10.804394	5
56	9.191130	9.994699	9.196440	10.803569	4
57	9.191933	9.994680	9.197253	10.802747	3
58	9.192734	9.994660	9.198074	10.801926	2
59	9.193534	9.994640	9.198894	10.801106	1
60	9.194332	9.994620	9.199712	10.800287	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 81.

Degree 9.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.194332	9.994620	9.199712	10.800287	60
1	9.195129	9.994600	9.200529	10.799470	59
2	9.195925	9.994580	9.201345	10.798655	58
3	9.196718	9.994560	9.202159	10.797841	57
4	9.197511	9.994540	9.202971	10.797029	56
5	9.198302	9.994519	9.203782	10.796218	55
6	9.199091	9.994499	9.204592	10.795408	54
7	9.199879	9.994479	9.205400	10.794600	53
8	9.200666	9.994459	9.206207	10.793793	52
9	9.201451	9.994438	9.207013	10.792987	51
10	9.202234	9.994418	9.207817	10.792183	50
11	9.203017	9.994398	9.208619	10.791381	49
12	9.203797	9.994377	9.209420	10.790580	48
13	9.204577	9.994357	9.210220	10.789780	47
14	9.205354	9.994336	9.211018	10.788982	46
15	9.206131	9.994316	9.211815	10.788185	45
16	9.206906	9.994295	9.212611	10.787389	44
17	9.207679	9.994274	9.213405	10.786595	43
18	9.208452	9.994254	9.214198	10.785802	42
19	9.209222	9.994233	9.214989	10.785011	41
20	9.209992	9.994212	9.215780	10.784220	40
21	9.210760	9.994191	9.216568	10.783432	39
22	9.211526	9.994171	9.217356	10.782644	38
23	9.212291	9.994150	9.218142	10.781858	37
24	9.213055	9.994129	9.218926	10.781074	36
25	9.213818	9.994108	9.219710	10.780290	35
26	9.214579	9.994087	9.220491	10.779508	34
27	9.215338	9.994066	9.221272	10.778728	33
28	9.216097	9.994044	9.222052	10.777948	32
29	9.216854	9.994024	9.222830	10.777170	31
30	9.217609	9.994003	9.223607	10.776393	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 80.

Degree 9.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.217609	9.994003	9.223607	10.716393	30
31	9.218363	0.993982	6.224382	10.775618	29
32	9.219116	9.993960	9.225156	10.774844	28
33	9.219868	9.993939	9.225929	10.774071	27
34	9.220618	9.993918	9.226704	10.773300	26
35	9.221367	9.993897	9.227471	10.772529	25
36	9.222115	9.993875	9.228240	10.771760	24
37	9.222861	9.993854	9.229007	10.770993	23
38	9.223606	9.993832	9.229774	10.770226	22
39	9.224349	9.993811	9.230539	10.769461	21
40	9.225092	9.993789	9.231302	10.768698	20
41	9.225833	9.993768	9.232065	10.767935	19
42	9.226573	9.993746	9.232826	10.767174	18
43	6.227311	9.993725	9.233586	10.766414	17
44	9.228048	9.993703	9.234345	10.765655	16
45	9.228784	9.993681	9.235103	10.764897	15
46	9.229518	9.993660	9.235859	10.764141	14
47	9.230252	9.993638	9.236614	10.763386	13
48	6.230984	9.993616	9.237368	10.762632	12
49	6.231715	9.993594	9.138120	10.761880	11
50	9.232444	9.993572	9.238872	10.761128	10
51	9.233172	9.993550	9.239622	10.760378	9
52	9.233899	9.993528	9.240371	10.759629	8
53	9.234625	9.993506	9.241118	10.758882	7
54	9.235349	9.993484	9.241865	10.758135	6
55	9.236073	9.993462	9.242610	10.757390	5
56	9.236795	9.993440	9.243354	10.756646	4
57	9.237515	9.993418	9.244097	10.755903	3
58	9.238835	9.993396	9.244839	10.755161	2
59	9.238952	9.993374	9.245579	10.754421	1
60	9.239670	9.993351	9.246319	10.753681	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 80.

Degree 10.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.239670	9.993351	9.246319	10.753681	60
1	9.240386	9.993329	9.247057	10.752943	59
2	9.241101	9.993307	9.247794	10.752206	58
3	9.241814	9.993284	9.248530	10.751470	57
4	9.242526	9.993262	9.249264	10.750736	56
5	9.243237	9.993240	9.249998	10.750002	55
6	9.243947	9.993117	9.250730	10.749270	54
7	9.244656	9.993195	9.251461	10.748539	53
8	9.245363	9.993172	9.252191	10.747809	52
9	9.246070	9.993149	9.252920	10.747080	51
10	9.246775	9.993127	9.253648	10.746352	50
11	9.247478	9.993104	9.254374	10.745626	49
12	9.248181	9.993011	9.255200	10.744900	48
13	9.248883	9.993059	9.255824	10.744176	47
14	9.249583	9.993036	9.256547	10.743453	46
15	9.250282	9.993013	9.257269	10.742731	45
16	9.250980	9.992990	9.257990	10.742010	44
17	9.251677	9.992967	9.258710	10.741290	43
18	9.252373	9.992944	9.259429	10.740571	42
19	9.253067	9.992921	9.260146	10.739854	41
20	9.253761	9.992898	9.260863	10.739137	40
21	9.254453	9.992875	9.261578	10.738422	39
22	9.255144	9.992852	9.262292	10.737708	38
23	9.255834	9.992829	9.263005	10.736995	37
24	9.256523	9.992806	9.263717	10.736283	36
25	9.257211	9.992783	9.264428	10.735572	35
26	9.257898	9.992759	9.265138	10.734862	34
27	9.258583	9.992736	9.265847	10.734153	33
28	9.259268	9.992613	9.266555	10.733445	32
29	9.259951	9.992690	9.267261	10.732739	31
30	9.260633	9.992666	9.267967	10.732033	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 79.

Degree 10.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.260633	9.992666	9.267967	10.732033	30
31	9.261314	9.992643	9.268671	10.731329	29
32	9.261994	9.992619	9.269375	10.730625	28
33	9.262673	9.992596	9.270078	10.729923	27
34	9.263351	9.992572	9.270779	10.729221	26
35	9.264027	9.992549	9.271479	10.728521	25
36	9.264703	9.992525	9.272178	10.727822	24
37	9.265378	9.992501	9.272876	10.727124	23
38	9.266051	9.992478	9.273573	10.726427	22
39	9.266723	9.992454	9.274269	10.725731	21
40	9.267395	9.992420	9.274964	10.725036	20
41	9.268065	9.992406	9.275658	10.724342	19
42	9.268734	9.992382	9.276351	10.723649	18
43	9.269402	9.992362	9.277043	10.722957	17
44	9.270069	9.992335	9.277734	10.722267	16
45	9.270735	9.992311	9.278424	10.721576	15
46	9.271400	9.992287	9.279113	10.720887	14
47	9.272063	9.992263	9.279801	10.720199	13
48	9.272726	9.992239	9.280488	10.719512	12
49	9.273388	9.992214	9.281174	10.718826	11
50	9.274049	9.992190	9.281858	10.718142	10
51	9.274708	9.992166	9.282542	10.717458	9
52	9.275367	9.992142	9.283225	10.716775	8
53	9.276025	9.992118	9.283907	10.716093	7
54	9.276681	9.992093	9.284588	10.715412	6
55	9.277337	9.992069	9.285268	10.714732	5
56	9.277991	9.992045	9.285946	10.714053	4
57	9.278685	9.992020	9.286624	10.713376	3
58	9.279297	9.991996	9.287301	10.712699	2
59	9.279948	9.991971	9.287977	10.712023	1
60	9.280599	9.991947	9.288652	10.711348	0
	Co sine	Sine	Co-tang.	Tangent	M

Degree 79.

Degree 11.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.280599	9.991947	9.288652	10.711348	60
1	9.281229	9.991922	9.289326	10.710674	59
2	9.281897	9.991897	9.289999	10.710001	58
3	9.282544	9.991873	9.290671	10.709329	57
4	9.283190	9.991848	9.291342	10.708658	56
5	9.283836	9.991823	9.292013	10.707987	55
6	9.284480	9.991799	9.992682	10.707318	54
7	9.285124	9.991774	9.293350	10.706650	53
8	9.285766	9.991749	9.294017	10.705983	52
9	9.286408	9.991724	9.294684	10.705316	51
10	9.287048	9.991699	9.295349	10.704651	50
11	9.287688	9.991674	9.296013	10.703987	49
12	9.288326	9.991649	9.296677	10.703323	48
13	9.288964	9.991624	9.297339	10.702661	47
14	9.289600	9.991599	9.298001	10.701999	46
15	9.290236	9.991574	9.298662	10.701338	45
16	9.290870	9.991549	9.299322	10.700678	44
17	9.291504	9.991524	9.299980	10.700020	43
18	9.292137	9.991498	9.300638	10.699362	42
19	9.292768	9.991473	9.301295	10.698705	41
20	9.293399	9.991448	9.301951	10.698049	40
21	9.294029	9.991422	9.302607	10.697393	39
22	9.294658	9.991397	9.303261	10.696739	38
23	9.295286	9.991372	9.303914	10.696086	37
24	9.295913	9.991346	9.304567	10.695433	36
25	9.296539	9.991321	9.305218	10.694782	35
26	9.297164	9.991295	9.305867	10.694131	34
27	9.297788	9.991270	9.306519	10.693481	33
28	9.298412	9.991244	9.307168	10.692832	32
29	9.299034	9.991218	9.307816	10.692184	31
30	9.299655	9.991193	9.308463	10.691537	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 78.

Degree 11.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.299655	9.991193	9.308463	10.691537	30
31	9.300276	9.991167	9.309109	10.690891	29
32	9.300895	9.991141	9.309754	10.690246	28
33	9.301514	9.991115	9.310399	10.689601	27
34	9.302132	9.991090	9.311042	10.688958	26
35	9.302749	9.991064	9.311685	10.688315	25
36	9.303364	9.991038	9.312327	10.687673	24
37	9.303979	9.991012	9.312968	10.687032	23
38	9.304593	9.990986	9.313608	10.686392	22
39	9.305207	9.990960	9.314247	10.685753	21
40	9.305819	9.990934	9.314885	10.685115	20
41	9.306430	9.990908	9.315523	10.684477	19
42	9.307041	9.990882	9.316159	10.683841	18
43	9.307650	9.990855	9.316795	10.683205	17
44	9.308259	9.990829	9.317430	10.682570	16
45	9.308867	9.990803	9.318064	10.681936	15
46	9.309474	9.990777	9.318697	10.681303	14
47	9.310080	9.990750	9.319330	10.680670	13
48	9.310685	9.990724	9.319961	10.680039	12
49	9.311289	9.990697	9.320592	10.679408	11
50	9.311899	9.990671	9.321222	10.678778	10
51	9.312495	9.990645	9.321851	10.678149	9
52	9.313097	9.990618	9.322479	10.677521	8
53	9.313698	9.990591	9.323106	10.676894	7
54	9.314297	9.990565	9.323733	10.676267	6
55	9.314897	9.990538	9.324358	10.675642	5
56	9.315495	9.990512	9.324983	10.675017	4
57	9.316092	9.990485	9.325607	10.674393	3
58	9.316689	9.990458	9.326231	10.673769	2
59	9.317284	9.990431	9.326853	10.673147	1
60	9.317879	9.990404	9.327475	10.672525	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 78.

Degree 12.

M.	Sine	Co-sine	Tangent	Co-tang.	
0	9.317879	9.990404	9.327475	10.672525	60
1	9.318473	9.990377	9.328095	10.671905	59
2	9.319066	9.990351	9.328715	10.671285	58
3	9.319658	9.990324	9.329334	10.670666	57
4	9.322250	9.990297	9.329953	10.670047	56
5	9.320840	9.990270	9.320570	10.669430	55
6	9.321430	9.990242	9.331187	10.668813	54
7	9.322019	9.990215	9.331803	10.668197	53
8	9.322607	9.990188	9.332418	10.667582	52
9	9.323194	9.990161	9.333033	10.666967	51
10	9.323780	9.990134	9.333646	10.666354	50
11	9.324366	9.990107	9.334259	10.665741	49
12	9.324950	9.990079	9.334871	10.665129	48
13	9.325534	9.990052	9.335482	10.664518	47
14	9.326117	9.990025	9.336093	10.663907	46
15	9.326699	9.989997	9.336702	10.663298	45
16	9.327281	9.989970	9.337311	10.662689	44
17	9.327862	8.989942	9.337919	10.662081	43
18	9.328441	9.989915	9.338527	10.661473	42
19	9.329020	6.989887	9.339133	10.660867	41
20	9.329599	9.989860	9.339739	10.660261	40
21	9.330176	9.989832	9.340344	10.659656	39
22	9.330753	9.989804	9.340948	10.659052	38
23	9.331328	9.989777	9.341552	10.658448	37
24	9.331903	9.989749	9.342155	10.657845	36
25	9.332478	9.989721	9.342757	10.657243	35
26	9.333051	9.989693	9.343358	10.656642	34
27	9.333624	9.989665	9.343958	10.656042	33
28	9.334195	9.989637	9.344558	10.655442	32
29	9.334766	9.989609	9.345157	10.654843	31
30	9.335337	9.989581	9.345755	10.654245	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 77.

Degree 12.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.335337	9.989581	9.345755	10.654245	30
31	9.335906	9.989553	9.346353	10.653647	29
32	9.336475	9.989525	9.346949	10.653051	28
33	9.337043	9.989597	9.347545	10.652455	27
34	9.337610	9.989469	9.348141	10.651859	26
35	9.338176	9.989441	9.348735	10.651265	25
36	9.338742	9.989413	9.349329	10.650671	24
37	9.339306	9.989384	9.349922	10.650078	23
38	9.339870	9.989356	9.350514	10.649486	22
39	9.340434	9.989328	9.351106	10.648894	21
40	9.340996	9.989299	9.351697	10.648303	20
41	9.341558	9.989271	9.352287	10.647713	19
42	9.342119	9.989243	9.352876	10.647124	18
43	9.342679	9.989214	9.353465	10.646535	17
44	9.343239	9.989186	9.354053	10.645947	16
45	9.343797	9.989157	9.354640	10.645360	15
46	9.344355	9.989128	9.355227	10.644773	14
47	9.344912	9.989100	9.355812	10.644187	13
48	9.345469	9.989071	9.356398	10.643602	12
49	9.346024	9.989042	9.356982	10.643018	11
50	9.346579	9.989014	9.357566	10.642434	10
51	9.347134	9.988985	9.358149	10.641851	9
52	9.347687	9.988956	9.358731	10.641269	8
53	9.348240	9.988927	9.359313	10.640687	7
54	9.348792	9.988898	9.359893	10.640107	6
55	9.349343	9.988869	9.360474	10.639526	5
56	9.349893	9.988840	9.361053	10.638947	4
57	9.350443	9.988811	9.361632	10.638369	3
58	9.350992	9.988782	9.362210	10.637790	2
59	9.351540	9.988754	9.362787	10.637213	1
60	9.352088	9.988724	9.363364	10.636636	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 77.

Degree 13.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.352088	9.988724	9.363364	10.636636	60
1	9.352635	9.988695	9.363940	10.636060	59
2	9.353181	9.988666	9.364515	10.635485	58
3	9.353726	9.988636	9.365090	10.634910	57
4	9.354271	9.988607	9.365664	10.634336	56
5	9.354185	9.988578	9.366237	10.633763	55
6	9.355358	9.988548	9.366810	10.633190	54
7	9.355901	9.988519	9.367382	10.632618	53
8	9.356443	9.988489	9.367953	10.632047	52
9	9.356984	9.988460	9.368524	10.631476	51
10	9.357524	9.988430	9.369094	10.630906	50
11	9.358064	9.988401	9.369663	10.630337	49
12	9.358603	9.988371	9.370232	10.629768	48
13	9.359141	9.988341	9.370799	10.629201	47
14	9.359679	9.988312	9.371367	10.628633	46
15	9.350215	9.988282	9.371933	10.628067	45
16	9.360752	9.988252	9.372499	10.627501	44
17	9.361287	9.988223	9.373064	10.626936	43
18	9.361822	9.988193	9.373629	10.626371	42
19	9.362356	9.988163	9.374193	10.625807	41
20	9.362889	9.988133	9.374756	10.625244	40
21	9.363422	9.988103	9.375319	10.624681	39
22	9.363954	9.988073	9.375881	10.624119	38
23	9.364485	9.988043	9.376442	10.623558	37
24	9.365016	9.988013	9.377003	10.622997	36
25	9.365546	9.987983	9.377562	10.622437	35
26	9.366075	9.987953	9.378122	10.621878	34
27	9.366604	9.987922	9.378681	10.621319	33
28	9.367132	9.987892	9.379239	10.620761	32
29	9.367659	9.987862	9.379797	10.620203	31
30	9.368185	9.987832	9.380354	10.619646	30
	Co-sine	Sine.	Co-tang.	Tangent	M

Degree 76.

Degree 13.

M	Sine	*Co-sine*	Tangent	*Co-tang.*	
30	9.368185	9.987832	9.380354	10.619646	30
31	9.368711	9.987801	9.380910	10.619090	29
32	9.369236	9.987771	9.381466	10.618534	28
33	9.369761	9.987740	9.382021	10.617980	27
34	9.370285	9.987710	9.382575	10.617425	26
35	9.370808	9.987679	9.383129	10.616871	25
36	9.371330	9.987649	9.383682	10.616318	24
37	9.371852	9.987618	9.384234	10.615766	23
38	9.372373	9.987588	9.384786	10.615214	22
39	9.372894	9.987557	9.385337	10.614663	21
40	9.373414	9.987526	9.385888	10.614112	20
41	9.373933	9.987496	9.386438	10.613562	19
42	9.374452	9.987465	9.386987	10.613013	18
43	9.374970	9.987434	9.387536	10.612464	17
44	9.375487	9.987403	9.388084	10.611916	16
45	9.376003	9.987372	9.388631	10.611369	15
46	9.376519	9.987341	9.389178	10.610822	14
47	6.377035	9.987310	9.389724	10.610276	13
48	9.377549	9.987279	9.390270	10.609730	12
49	9.378063	9.987248	9.390815	10.609185	11
50	9.378577	9.987217	9.391360	10.608640	10
51	9.379089	9.987186	9.391907	10.608097	9
52	9.379601	9.987155	9.392467	10.607553	8
53	9.380113	9.987124	9.392989	10.607011	7
54	9.380624	9.987092	9.393531	10.606469	6
55	9.381134	9.987061	9.394074	10.605927	5
56	9.381643	9.987030	9.394614	10.605386	4
57	9.382152	9.986998	9.395154	10.604846	3
58	9.382661	9.986967	9.395694	10.604306	2
59	9.383168	9.986936	9.396233	10.603767	1
60	9.383675	9.986904	9.396771	10.603229	0
	Co-sine	Sine	*Co-tang.*	Tangent	M

Degree 76.

Degree 14.

M	Sine	Co-fine	Tangent	Co-tang.	
0	9.383675	9.986904	9.396771	10.603229	60
1	9.384181	9.986873	9.397309	10.602694	59
2	9.384687	9.986841	9.397846	10.602154	58
3	9.385192	9.986809	9.398383	10.601617	57
4	9.385697	9.986778	9.398919	10.601081	56
5	9.386201	9.986746	9.399455	10.600545	55
6	9.386704	9.986714	9.399990	10.600010	54
7	9.387207	9.986683	9.400524	10.599476	53
8	9.387709	9.986651	9.401058	10.598942	52
9	9.388210	9.986619	9.401591	10.598409	51
10	9.388711	9.986587	9.402124	10.597876	50
11	9.389211	9.986555	9.402656	10.597344	49
12	9.389711	9.986523	9.403187	10.596813	48
13	9.390210	9.986491	9.403718	10.596282	47
14	9.390708	9.986459	9.404249	10.595751	46
15	9.391206	9.986427	9.404778	10.595222	45
16	9.391703	9.986395	9.405306	10.594692	44
17	9.392199	9.986363	9.405836	10.594164	43
18	9.392695	9.986338	9.406364	10.593636	42
19	9.393190	9.986299	9.405892	10.593608	41
20	9.393685	9.986266	9.407419	10.592581	40
21	9.394179	9.986234	9.407945	10.592055	39
22	9.394673	9.986201	9.408471	10.591529	38
23	9.395166	9.986169	9.408996	10.591001	37
24	9.395654	9.986137	9.409521	10.590479	36
25	9.396150	9.986104	9.410045	10.589954	35
26	9.396641	9.986072	9.410569	10.589431	34
27	9.397131	9.986039	9.411092	10.588908	33
28	9.397621	9.986007	9.411615	10.588385	32
29	9.398111	9.985974	9.412137	10.587863	31
30	9.398600	9.985942	9.412658	10.587342	30
	Co-fine	Sine	Co-tang.	Tangent	M

Degree 75.

Degree 14.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.398600	9.985942	9.412658	10.587342	30
31	9.399087	9.985909	9.413179	10.586821	29
32	9.399575	9.985876	9.413699	10.586301	28
33	9.400062	9.985843	9.414219	10.585781	27
34	9.400549	9.985811	9.414738	10.585262	26
35	9.401035	9.985778	9.415257	10.584742	25
36	9.401520	9.985745	9.415775	10.584225	24
37	9.402005	9.985712	9.416293	10.583707	23
38	9.402489	9.985679	9.416810	10.583190	22
39	9.402972	9.985646	9.417326	10.582674	21
40	9.403455	9.985613	9.417842	10.582157	20
41	9.403938	9.985580	9.418357	10.581642	19
42	9.404420	9.985547	9.418873	10.581127	18
43	9.404901	9.985513	9.419387	10.580613	17
44	9.405382	9.985480	9.419901	10.580099	16
45	9.405862	9.985447	9.420415	10.579585	15
46	9.406341	9.985414	9.420927	10.579072	14
47	9.406820	9.985380	9.421440	10.578560	13
48	9.407299	9.985347	9.421951	10.578048	12
49	9.407776	9.985314	9.422463	10.577537	11
50	9.408254	9.985280	9.422973	10.577026	10
51	9.408731	9.985247	9.423484	10.576516	9
52	9.409207	9.985213	9.423993	10.576007	8
53	9.409682	9.985180	9.424503	10.575497	7
54	9.410157	9.985146	9.425011	10.574989	6
55	9.410632	9.985112	9.425518	10.574480	5
56	9.411106	9.985079	9.426027	10.573973	4
57	9.411579	9.985045	9.426534	10.573466	3
58	9.412052	9.985011	9.427041	10.572959	2
59	9.412524	9.984977	9.427547	10.572453	1
60	9.412996	9.984943	9.428052	10.571947	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 75.

Degree 15.

M	Sine	Co sine	Tangent	Co-tang.	
0	9.412996	9.984944	9.428052	20.571947	60
1	9.413467	9.984910	9.428557	10.571442	59
2	9.413938	9.984876	9.429067	10.570938	58
3	9.414408	9.984842	9.429566	10.570434	57
4	9.414878	9.984808	9.430070	10.569930	56
5	9.415347	9.984774	9.430573	10.569427	55
6	9.415815	9.984740	9.431075	10.568925	54
7	9.416283	9.984706	9.431577	10.568423	53
8	9.416850	9.984672	9.432079	10.567921	52
9	9.417217	9.984637	9.432580	10.567420	51
10	9.417684	9.984603	9.433080	10.566920	50
11	9.418149	9.984569	9.433580	10.566419	49
12	9.418615	9.984535	9.434080	10.565920	48
13	9.419079	9.984500	9.434579	10.565421	47
14	9.419544	9.984466	9.435078	10.564922	46
15	9.420007	9.984431	9.435576	10.564424	45
16	9.420470	9.984397	9.436073	10.563927	44
17	9.420933	9.984363	9.436570	10.563430	43
18	9.421395	9.984328	9.437067	10.562933	42
19	9.421856	9.984293	9.437563	10.562437	41
20	9.422317	9.984259	9.438059	10.561941	40
21	9.42 778	9.984224	9.438554	10.561446	39
22	9.423238	9.984189	9.439048	10.560952	38
23	9.423697	9.984155	9.439543	10.560457	37
24	9.424156	9.984120	9.440036	10.559964	36
25	9.424615	9.984085	9.440529	10.559471	35
26	9.425072	9.984050	9.441022	10.558978	34
27	9.425530	9.984015	9.441514	10.558486	33
28	9.425987	9.983980	9.442006	10.557994	32
29	9.426443	9.983945	9.442497	10.557503	31
30	9.426899	9.983910	9.442988	10.557011	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 74.

Degree 15.

M	Sine	*Co-sine*	Tangent	*Co-tang.*	
30	9.426899	9.983910	9.442988	10.557011	30
31	9.427354	9.983875	9.443479	10.556521	29
32	9.427809	9.983840	9.443968	10.556031	28
33	9.428264	9.983805	9.444458	10.555542	27
34	9.428717	9.983770	9.444947	10.555053	26
35	9.429170	9.983735	9.445435	10.554565	25
36	9.429623	9.983699	9.445923	10.554077	24
37	9.430075	9.983664	9.446411	10.553589	23
38	9.430507	9.983629	9.446898	10.553102	22
39	9.430978	9.983593	9.447384	10.552616	21
40	9.431429	9.983558	9.447870	10.552129	20
41	9.431879	9.983523	9.448256	10.551644	19
42	9.432328	9.983487	9.448841	10.551159	18
43	9.432778	9.983452	9.449326	10.550674	17
44	9.433296	9.983416	9.449870	10.550181	16
45	9.433674	9.983380	9.450294	10.549706	15
46	9.434122	9.983345	9.450777	10.549223	14
47	9.434569	9.983309	9.451260	10.548740	13
48	9.435016	9.983273	9.451743	10.548257	12
49	9.435462	9.983238	9.452225	10.547775	11
50	9.435918	9.983202	9.452706	10.547294	10
51	9.436353	9.983166	9.453187	10.546813	9
52	9.436798	9.983130	9.453668	10.546332	8
53	9.437242	9.983094	9.454148	10.545852	7
54	9.437686	9.983058	9.454629	10.545372	6
55	9.438129	9.983022	9.455107	10.544893	5
56	9.438572	9.982986	9.455586	10.544414	4
57	9.439014	9.982950	9.456064	10.543936	3
58	9.439456	9.982914	9.456542	10.543458	2
59	9.439897	9.982878	9.457019	10.542980	1
60	9.440338	9.982842	9.457496	10.542503	0
	Co-sine	Sine	*Co-tang*	Tangent	M

Degree 74.

Degree 16.

M.	Sine	Co-sine	Tangent	Co-tang.	
0	9.140338	9.982842	9.457496	10.542503	6
1	9.440778	9.982805	9.457973	10.542027	5
2	9.441218	9.982769	9.458449	10.541551	5
3	9.441658	9.982733	9.458925	10.541075	5
4	9.442096	9.982695	9.459400	10.540600	5
5	9.442535	9.982660	9.459875	10.540125	5
6	9.442973	9.982623	9.460349	10.539651	5
7	9.443416	9.982587	9.460829	10.539177	5
8	9.443848	9.982550	9.461297	10.538703	5
9	9.444284	9.982514	9.461770	10.538230	5
10	9.444720	9.982477	9.462242	10.537758	5
11	9.445155	9.982441	9.462714	10.537285	4
12	9.445590	9.982404	9.463186	10.536814	4
13	9.446025	9.982367	9.463658	10.536342	4
14	9.446459	9.9823 0	9.464129	10.535871	4
15	9.446893	9.982294	9.464599	10.535401	4
16	9.447326	9.982257	9.465069	10.534931	4
17	9.447759	9.982220	9.465539	10.534461	4
18	9.448191	9.982183	9.466008	10.533992	4
19	9.448623	9.982146	9.466476	10.533523	4
20	9.449054	9.982109	9.466945	10.533055	4
21	9.449485	9.982072	9.467413	10.532587	3
22	9.449915	9.982035	9.467880	10.532120	3
23	9.450345	9.981998	9.468347	10.531653	3
24	9.450775	9.981961	9.468814	10.531186	3
25	9.451203	9.981922	9.469280	10.530720	3
26	9.451632	9.981886	9.469746	10.530254	3
27	9.452060	9.981849	9.470211	10.529789	3
28	9.452488	9.981812	9.470676	10.529324	3
29	9.452915	9.981774	9.471141	10.528859	3
30	9.453342	9.981737	9.471605	10.528395	3
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 73.

Degree 16.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.453342	9.981737	9.471605	10.528395	30
31	9.453768	9.981699	9.472068	10.527931	29
32	9.454194	9.981662	9.472532	10.527468	28
33	9.454619	9.981624	9.472995	10.527005	27
34	9.455044	9.981587	9.473457	10.526543	26
35	9.455469	9.981549	9.473919	10.526081	25
36	9.455892	9.981512	9.474381	10.525619	24
37	9.456316	9.981474	9.474842	10.525158	23
38	9.456739	9.981436	9.475303	10.524695	22
39	9.457162	9.981398	9.475763	10.524237	21
40	9.457584	9.981361	9.476223	10.523777	20
41	9.458006	9.981323	9.476683	10.523317	19
42	9.458427	9.981285	9.477142	10.522858	18
43	9.458848	9.981247	9.477601	10.522399	17
44	9.459268	9.981209	9.478059	10.521941	16
45	9.459684	9.981171	9.478517	10.521483	15
46	9.460108	9.981133	9.478975	10.521025	14
47	9.460527	9.981095	9.479432	10.520568	13
48	9.460945	9.981057	9.479889	10.520111	12
49	9.461364	9.981019	9.480345	10.519655	11
50	9.461782	9.980980	9.480801	10.519199	10
51	9.462199	9.980942	9.481257	10.518743	9
52	9.462616	9.980904	9.481712	10.518288	8
53	9.463032	9.980866	9.482167	10.517833	7
54	9.463448	9.980827	9.482621	10.517379	6
55	9.463864	9.980789	9.483075	10.516925	5
56	9.464279	9.980750	9.483528	10.516471	4
57	9.464694	9.980712	9.483982	10.516018	3
58	9.465108	9.980672	9.484434	10.515565	2
59	9.465522	9.980635	9.484887	10.515113	1
60	9.465953	9.980596	9.485339	10.514661	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 73.

Degree 17.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.465935	9.980596	9.485339	10.514661	60
1	9.466348	9.980558	9.485791	10.514209	59
2	9.466761	9.980519	9.486242	10.513758	58
3	9.467173	9.980480	9.486693	10.513307	57
4	9.467585	9.980441	9.487143	10.512857	56
5	9.467996	9.980403	9.487593	10.512407	55
6	9.468407	9.980364	9.488043	10.511957	54
7	9.468817	9.980325	9.488493	10.511507	53
8	9.469227	9.980286	9.488941	10.511059	52
9	9.469637	9.980247	9.489390	10.510610	51
10	9.460446	9.980208	9.489838	10.510162	50
11	9.470455	9.980169	9.490286	10.509714	49
12	9.471863	9.980130	9.490733	10.509267	48
13	9.471071	9.980091	9.491180	10.508820	47
14	9.471678	9.980052	9.491627	10.508373	46
15	9.472086	9.980012	9.492073	10.507928	45
16	9.472492	9.979973	9.492519	10.507481	44
17	9.472898	9.979934	9.492964	10.507035	43
18	9.473304	9.979894	9.493410	10.506590	42
19	9.473710	9.979855	9.493854	10.506145	41
20	9.474115	9.979816	9.494299	10.505701	40
21	9.474519	9.979776	9.494743	10.505257	39
22	9.474923	9.979737	9.495186	10.504813	38
23	9.475327	9.979697	9.495630	10.504370	37
24	9.475730	9.979658	9.496073	10.503928	36
25	9.476133	9.979618	9.496515	10.503485	35
26	9.476536	9.979578	9.496957	10.503043	34
27	9.476938	9.979539	9.497399	10.502601	33
28	9.477340	9.979499	9.497840	10.502160	32
26	9.477741	9.979459	9.498282	10.501718	31
30	9.478142	9.979419	9.498722	10.501278	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 72.

Degree 17.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.478142	9.979419	9.498722	10.501278	30
1	9.478542	9.979380	9.499163	10.500837	29
2	9.478942	9.979340	9.499602	10.500398	28
3	9.479342	9.979300	9.500042	10.499958	27
4	9.479741	9.979260	9.500481	10.499519	26
5	9.480140	9.979220	9.500920	10.499080	25
6	9.480538	9.979180	9.501359	10.498641	24
7	9.480936	9.979140	9.501797	10.498203	23
8	9.481334	9.979099	9.502234	10.497765	22
9	9.481731	9.979059	9.502672	10.497328	21
10	9.482128	9.979019	9.573109	10.496891	20
11	9.482525	9.978930	9.503546	10.496454	19
12	9.482921	9.978939	9.503982	10.496018	18
13	9.483316	9.978898	9.504418	10.495582	17
14	9.483711	9.978858	9.504854	10.495146	16
15	9.484106	9.978817	9.505289	10.494711	15
16	9.484501	9.978777	9.505724	10.494216	14
17	9.484895	9.978736	9.506158	10.493841	13
18	9.485289	9.978696	9.506593	10.493407	12
19	9.485682	9.978655	9.507026	10.492973	11
20	9.486075	9.978615	9.507459	10.492540	10
21	9.486467	9.978574	9.507892	10.492107	9
22	9.486859	9.978533	9.508326	10.491674	8
23	9.487251	9.978493	9.508759	10.491241	7
24	9.487642	9.978452	9.509181	10.490809	6
25	9.488033	9.978411	9.509622	10.490377	5
26	9.488424	9.978370	9.510044	10.489946	4
27	9.488814	9.978329	9.510486	10.489515	3
28	9.489204	9.978288	9.510915	10.489084	2
29	9.489593	9.978247	9.511346	10.488654	1
30	9.489982	9.978205	9.511776	10.488225	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 72.

Degree 18.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.489982	9.978206	9.511776	10.488224	60
1	9.490371	9.978165	9.512206	10.487794	59
2	9.490759	9.978124	9.512635	10.487365	58
3	9.491147	9.978083	9.513064	10.486936	57
4	9.491534	9.978042	9.513493	10.486507	56
5	9.491922	9.978000	9.513921	10.486079	55
6	9.492308	9.977956	9.514349	10.485651	54
7	9.492695	9.977918	9.514777	10.485223	53
8	9.493080	9.977877	9.515204	10.484796	52
9	9.493466	9.977835	9.515631	10.484369	51
10	9.493851	9.977794	9.516057	10.483942	50
11	9.494236	9.977752	9.516484	10.483516	49
12	9.494620	9.977711	9.516910	10.483090	48
13	9.495005	9.977669	9.517335	10.482665	47
14	9.495388	9.977628	9.517761	10.482239	46
15	9.495771	9.977586	9.518185	10.481814	45
16	9.496154	9.977544	9.518610	10.481390	44
17	9.496537	9.977503	9.519034	10.480966	43
18	9.496919	9.977461	9.519458	10.480542	42
19	9.497301	9.977419	9.519882	10.480118	41
20	9.497682	9.977377	9.520305	10.489695	40
21	9.498063	9.977335	9.520728	10.479272	39
22	9.498444	9.977293	9.521151	10.478849	38
23	9.498824	9.977251	9.521573	10.478427	37
24	9.499204	9.977209	9.521995	10.478005	36
25	9.499584	9.977167	9.522417	10.477583	35
26	9.499963	9.977125	9.522838	10.477162	34
27	9.500342	9.977083	9.523259	10.476741	33
28	9.500720	9.977041	9.523679	10.476320	32
29	9.501099	9.976999	9.524109	10.475900	31
30	9.501476	9.976956	9.524520	10.475480	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 71.

Degree 18.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.501476	9.977956	9.524520	10.475 80	30
31	9.501854	9.97[illegible]914	9.524939	10.475060	29
32	9.502231	9.976872	9.525359	10.474641	28
33	9.502607	9.976830	9.525778	10.474222	27
34	9.502984	9.976787	9.526197	10.473803	26
35	9.503360	9.976745	9.526615	10.473385	25
36	9.503735	9.976702	9.527033	10.472967	24
37	9.504110	9.976660	9.527451	10.472549	23
38	9.504485	9.976617	9.527868	10.472132	22
39	9.504840	9.976574	9.528285	10.471715	21
40	9.505234	9.976532	9.528702	10.4712,8	20
41	9.505608	9.976489	9.529118	10.470881	19
42	9.505981	9.976446	9.529535	10.470465	18
43	9.506354	9.976404	9.529950	10.470, 49	17
44	9.506727	9.976361	9.5 0366	10 469634	16
45	9.507099	9.976318	9.530781	1 .469219	15
46	9.507471	9.976275	9.531196	10.468804	14
47	9.507843	9.976232	9.531611	10 468389	13
48	9.508214	9.976185	9.532025	10.467975	12
49	9 508585	9.976146	9.532436	10.467561	11
50	9.508955	9.976103	9.532852	10:467147	10
51	9.509326	9.976060	9.533266	10.466734	9
52	9.509696	9.976017	9.533679	10.466321	8
53	9.510065	9.975973	9.534092	10.465908	7
54	9 510434	9.975930	9.534504	10.465496	6
55	9.510803	9.975887	9.534916	10.465084	5
56	9.511171	9.975814	9.535328	10.464672	4
57	9.511540	9.975800	9.535739	10.464261	3
58	9.511907	9 975757	9 536150	10.463849	2
59	9.512275	9.975713	.536561	10.463439	1
60	9 512642	9.975670	9.536972	10.4630 8	0
M	Co-sine	Sine	Co-Tang.	Tangent	M

Degree 71.

Degree 19.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.512642	9.975670	9.536972	10.463028	60
1	9.513009	9.975626	9.537382	10.462618	59
2	9.513375	9.975583	9.537792	10.462208	58
3	9.513741	9.975539	9.538202	10.461798	57
4	9.514107	9.975496	9.538610	10.461389	56
5	9.514472	9.975452	9.539020	10.460980	55
6	9.514837	9.975408	9.539429	10.460571	54
7	9.515202	9.975364	9.539837	10.460163	53
8	9.515566	9.975321	9.540245	10.459755	52
9	9.515930	9.975277	9.540653	10.459347	51
10	9.516294	9.975233	9.541061	10.458939	50
11	9.516657	9.975189	9.541468	10.458532	49
12	9.517020	9.975145	9.541875	10.458125	48
13	9.517382	9.975101	9.542281	10.457719	47
14	9.517745	9.975057	9.542688	10.457312	46
15	9.518107	9.975013	9.543094	10.456906	45
16	9.518468	9.974969	9.543499	10.456501	44
17	9.518829	9.974925	9.543905	10.456095	43
18	9.519190	9.974880	9.544310	10.455690	42
19	9.519551	9.974836	9.544715	10.455285	41
20	9.519911	9.974792	9.545119	10.454881	40
21	9.520271	9.974747	9.545524	10.454476	39
22	9.520631	9.974703	9.545927	10.454072	38
23	9.520990	9.974659	9.546331	10.453669	37
24	9.521349	9.974614	9.546735	10.453265	36
25	9.521707	9.974570	9.547138	10.452862	35
26	9.522065	9.974525	9.547540	10.452459	34
27	9.522423	9.974480	9.547943	10.452057	33
28	9.522781	9.974436	9.548345	10.451655	32
29	9.523138	9.974391	9.548747	10.451253	31
30	9.523495	9.974347	9.549149	10.450851	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 70.

Degree 19.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9 523495	9.974346	9.549149	10.450851	30
31	9.523851	9.974302	9 549550	10.450450	29
32	9.524208	9.974257	9.549951	10.450049	28
33	9.524564	9.974212	9.550352	10.449648	27
34	9.524920	9.974167	9.550752	10 449 248	26
35	9.525275	9.974122	9.551152	10.448848	25
36	9.525630	9.974077	9.551552	10.448448	24
37	9.525984	9.974032	9.551952	10.448048	23
38	9.526339	9.973987	9.552351	10.447649	22
39	9.526693	9.973942	9.552750	10.447250	21
40	9.527046	9.973897	9.553149	10 446851	20
41	9.527400	9.973852	9.553548	10.446452	19
42	9.527753	9.973807	9.553946	10.446054	18
43	9.528105	9.973761	9.554344	10.445656	17
44	9.528458	9.973716	9.554741	10.445259	16
45	9.528810	9.973671	9.555139	10.444861	15
46	9.529161	9.973625	9.555536	10.444464	14
47	9.529513	9 973580	9.555932	10.444068	13
48	9.529864	9 973535	9.556329	10.443671	12
49	9.530214	9.973489	9.556725	10.443275	11
50	9.530565	9.973443	9.557121	10 442879	10
51	9.530915	9.973398	9.557517	10.442483	9
52	9.531265	9.973352	9.557912	10.442088	8
53	9.531614	9.973307	9 558308	10.441693	7
54	9.531963	9.973261	9.558702	10.441298	6
55	9.532312	9 973215	9.559097	10.440903	5
56	9.532661	9.973169	9 559491	10 440509	4
57	9.533009	9 973123	9.559885	10.440115	3
58	9.533357	9.973078	9.560279	10.439721	2
59	9.533704	9.973032	9.560673	10.439327	1
60	9.534052	9.972986	9.561066	10.438934	0
M	Co-sine	Sine	Co-tang.	Tangent	M

Degree 70.

Degree 20.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.534052	9.97 986	9.561066	10.438934	60
1	9.534399	9.972940	9.561459	10.438541	59
2	9.534746	9.972894	9.561851	10.438148	58
3	9.535091	9.972848	9.562244	10.437756	57
4	9.535437	9.972801	9.562636	10.437364	56
5	9.535782	9.972755	9.563028	10 436972	55
6	9.536129	9.972709	9.563419	10.436580	54
7	9.536474	9.972663	9.563811	10.436189	53
8	9.536818	9.972617	9.564202	10 435798	52
9	9.537163	9.972570	9.564592	10.435407	51
10	9.537507	9.972524	9.564983	10 435017	50
11	9.537851	9.972477	9.565373	10.434627	49
12	9.538194	9.972431	9.565763	10.434237	48
13	9.538537	9.972384	9.566153	10.433847	47
14	9.538880	9.972338	9.566542	10.433457	46
15	9.539222	9.972291	9.566932	10.433068	45
16	9.539566	9.972245	9.567320	10.432679	44
17	9.539907	9.972198	9 567709	10.432291	43
18	9.540249	9.972151	9.568097	10.431902	42
19	9.540590	9.972105	9.568486	10 431514	41
20	9.540931	9.972058	9.569873	10.431126	40
21	9.541272	9.972011	9.569261	10.430739	39
22	9.541612	9.971964	9.569648	10.430351	38
23	9.541953	4.971917	9.560035	10.429964	37
24	9.542292	9.971870	9.5604 2	10.429578	36
25	9.542632	9.971823	9.560809	10.429191	35
26	9.542971	9.971776	9.571195	10.428805	34
27	9.543310	9 971729	9.571581	10.428419	33
28	9.543649	9.971682	9.571967	10.428033	32
29	9.543987	9.971635	9.572352	10 427648	31
30	9.544325	9.971588	9.572738	10.427262	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 69.

Degree 20.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.544325	9.971588	9.572738	10.427262	30
31	9.544663	9.971540	9.573123	10.426877	29
32	9.545000	9.971492	9.573507	10.426492	28
33	9.545338	9.971446	9.573892	10.426108	27
34	9.545674	9.971398	9.574276	10.425724	26
35	9.546011	9.971351	9.574660	10.425340	25
36	9.546347	9.971303	9.575044	10.424956	24
37	9.546683	9.971256	9.575427	10.424573	23
38	9.547019	9.971208	9.575810	10.424189	22
39	9.547354	9.971161	9.576193	10.423807	21
40	9.547689	9.971112	9.576576	10.423424	20
41	9.548024	9.971065	9.576958	10.423041	19
42	9.548358	9.971018	9.577341	10.422659	18
43	9.548693	9.970970	9.577723	10.422277	17
44	9.549026	9.970923	9.578104	10.421896	16
45	9.549360	9.970874	9.578486	10.421514	15
46	9.549693	9.970826	9.578867	10.421133	14
47	9.550026	9.970779	9.579248	10.420752	13
48	9.550359	9.970731	9.579628	10.420371	12
49	9.550692	9.970683	9.580009	10.419991	11
50	9.551024	9.970634	9.580389	10.419611	10
51	9.551355	9.970586	9.580769	10.419231	9
52	9.551687	9.970538	9.581149	10.418851	8
53	9.552018	9.970490	9.581528	10.418472	7
54	9.552349	9.970442	9.581907	10.418092	6
55	9.552680	9.970394	9.582286	10.417713	5
56	9.553010	9.970345	9.582665	10.417335	4
57	9.553340	9.970297	9.583043	10.416956	3
58	9.553670	9.970249	9.583422	10.416578	2
59	9.554000	9.970200	9.583800	10.416200	1
60	9.554329	9.970152	9.584177	10.415823	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 69.

Degree 21.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.554329	9.970152	9.584177	10.415822	60
1	9.554658	9.970103	9.584555	10.415445	59
2	9.554987	9.970055	9.584932	10.415068	58
3	9.555315	9.970006	9.585308	10.414691	57
4	9.555643	9.969957	9.585686	10.414314	56
5	9.555971	9.969909	9.586062	10.413938	55
6	9.556299	9.969860	9.586439	10.413561	54
7	9.556626	9.969811	9.586815	10.413185	53
8	9.556953	9.969762	9.587190	10.412809	52
9	9.557279	9.969713	9.587566	10.412434	51
10	9.557606	9.969665	9.587941	10.412059	50
11	9.557932	9.969616	9.588316	10.411684	49
12	9.558258	9.969567	9.588691	10.411309	48
13	9.558583	9.969518	9.589066	10.410934	47
14	9.558909	9.969469	9.589440	10.410560	46
15	9.559234	9.969419	9.589814	10.410185	45
16	9.559558	9.969370	9.590188	10.409812	44
17	9.559883	9.969321	9.590561	10.409438	43
18	9.560207	9.969272	9.590935	10.409065	42
19	9.560531	9.969223	9.591308	10.408692	41
20	9.560855	9.969173	9.591681	10.408319	40
21	9.561178	9.969124	9.592054	10.407946	39
22	9.561501	9.969075	9.592426	10.407574	38
23	9.561824	9.969025	9.592798	10.407201	37
24	9.562146	9.968976	9.593170	10.406829	36
25	9.562468	9.968926	9.593542	10.406457	35
26	9.562790	9.968877	9.593914	10.406086	34
27	9.563112	9.968827	9.594285	10.405715	33
28	9.563433	9.968777	9.594656	10.405344	32
29	9.563754	9.968728	9.595027	10.404973	31
30	9.564075	9.968678	9.595397	10.404602	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 68.

Degree 21.

M	Sine	Co-sine	Tangent	Co-Tang.	
30	9.564075	9.968678	9.595397	10.404602	30
31	9.564395	9.968628	9.595768	10.404232	29
32	9.564716	9.968578	9.596138	10.403862	28
33	9.565036	9.968528	9.596508	10.403492	27
34	9.565356	9.968478	9.596878	10.403122	26
35	9.565675	9.968428	9.597247	10.402753	25
36	9.565995	9.968378	9.597616	10.402384	24
37	9.566314	9.968328	9.597985	10.402015	23
38	9.566632	9.968278	9.598354	10.401646	22
39	9.566951	9.968228	9.598722	10.401277	21
40	9.567269	9.968178	9.599091	10.400909	20
41	9.567587	9.968128	9.599459	10.400541	19
42	9.567904	9.968078	9.599827	10.400173	18
43	9.568222	9.968027	9.600194	10.399806	17
44	9.568539	9.967977	9.600562	10.399438	16
45	9.568855	9.967927	9.600929	10.399071	15
46	9.569172	9.967876	9.601296	10.398704	14
47	9.569488	9.967826	9.601662	10.398337	13
48	9.569804	9.967775	9.602029	10.397971	12
49	9.570120	9.967725	9.602395	10.397605	11
50	9.570435	9.967674	9.602761	10.397239	10
51	9.570751	9.967623	9.603127	10.396873	9
52	9.571065	9.967573	9.603493	10.396507	8
53	9.571380	9.967522	9.603858	10.396142	7
54	9.571695	9.967471	9.604223	10.395777	6
55	9.572009	9.967420	9.604588	10.395412	5
56	9.572322	9.967370	9.604953	10.395047	4
57	9.572636	9.967319	9.605317	10.394683	3
58	9.572949	9.967268	9.605681	10.394318	2
59	9.573263	9.967217	9.606046	10.393954	1
60	9.573575	9.967166	9.606409	10.393592	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 68.

Degree 22.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.573575	9.967166	9.606409	10.393590	60
1	9.573888	9.967115	9.606773	10.393227	59
2	9.574200	9.967064	9.607136	10.392863	58
3	9.574512	9.967012	9.607500	10.392500	57
4	9.574824	9.966961	9.607862	10.392137	56
5	9.575135	9.966910	9.608225	10.391774	55
6	9.575447	9.966859	9.608588	10.391412	54
7	9.575758	9.966807	9.608950	10.391050	53
8	9.576068	9.966756	9.609312	10.390688	52
9	9.576379	9.966705	9.609674	10.390326	51
10	9.576689	9.966653	9.610036	10.389964	50
11	9.576999	9.966602	9.610397	10.389603	49
12	9.577309	9.966550	9.610758	10.389241	48
13	9.577618	9.966499	9.611119	10.388880	47
14	9.577927	9.966447	9.611480	10.388520	46
15	9.578236	9.966395	9.611841	10.388159	45
16	9.578545	9.966344	9.612201	10.387799	44
17	9.578853	9.966292	9.612561	10.387438	43
18	9.579161	9.966240	9.612921	10.387078	42
19	9.579469	9.966188	9.613281	10.386719	41
20	9.579777	9.966136	9.613641	10.386359	40
21	9.580084	9.966084	9.614000	10.386000	39
22	9.580392	9.966032	9.614359	10.385641	38
23	9.580698	9.965980	9.614718	10.385282	37
24	9.581005	9.965928	9.615077	10.384923	36
25	9.581311	9.965876	9.615435	10.384565	35
26	9.581618	9.965824	9.615793	10.384207	34
27	9.581923	9.965772	9.616151	10.383448	33
28	9.582229	9.965720	9.616509	10.383491	32
29	9.582534	6.965668	9.616867	10.383133	31
30	9.582840	9.965615	9.617224	10.382776	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 67.

Degree 22.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.582840	9.965615	9.617224	10.382776	30
31	9.583144	9.965563	9.617581	10.382418	29
32	9.583449	9.965511	9.617938	10.382061	28
33	9.583753	9.965458	9.618295	10.381705	27
34	9.584058	9.965406	9.618652	10.381348	26
35	9.584361	9.965353	9.619008	10.380992	25
36	9.584665	9.965301	9.619364	10.380635	24
37	9.584968	9.965248	9.619720	10.380279	23
38	9.585271	9.965195	9.620076	10.379924	22
39	9.585574	9.965143	9.620432	10.379568	21
40	9.585877	9.965090	9.620787	10.379213	20
41	9.586179	9.965037	9.621142	10.378858	18
42	9.586481	9.964984	9.621497	10.378503	17
43	9.586783	9.964931	9.622852	10.378148	16
44	9.587085	9.964878	9.622206	10.377793	15
45	9.587386	9.964825	9.622561	10.377439	14
46	9.587687	9.964772	9.622915	10.377085	13
47	9.587988	9.964719	9.623269	10.376731	12
48	9.588289	9.964666	9.623623	10.976377	11
49	9.588589	9.964613	9.623976	10.3760 4	10
50	9.588890	9.964560	9.624330	10.375670	9
51	9.589190	9.964507	9.624683	10.375317	8
52	9.589489	9.964454	9.625036	10.374964	7
53	9.589789	9.964400	9.625388	10.374612	6
54	9.590088	9.964347	9.625741	10.374259	5
55	9.590387	9.964294	9.626093	10.373907	4
56	9.590686	9.964240	9.626445	10.373555	3
57	9.590984	9.964187	9.626797	10.373203	2
58	9.591282	9.964133	9.627149	10.372850	1
59	9.591580	9.964080	9.627501	10.372499	0
60	9.591878	9.964026	9.627852	10.372148	
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 67.

Degree 23.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.591878	9.964026	9.627852	10.372148	60
1	9.592175	9.963972	9.628203	10.371797	59
2	9.592473	9.963919	9.628554	10.371446	58
3	9.592770	9.963865	9.628905	10.371095	57
4	9.593067	9.963811	9.629255	10.370744	56
5	9.593363	9.963757	9.629606	10.370394	55
6	9.593659	9.963703	9.629956	10.370044	54
7	9.593955	9.963650	9.630306	10.369694	53
8	9.594251	9.963596	9.630655	10.369344	52
9	9.594547	9.963542	9.631005	10.368995	51
10	9.594842	9.963488	9.631354	10.368645	50
11	9.595137	9.963433	9.631704	10.368296	49
12	9.595432	9.963379	9.632053	10.367947	48
13	9.595727	9.963325	9.632401	10.367598	47
14	9.596021	9.963271	9.632750	10.367250	46
15	9.596315	9.963217	9.633098	10.366901	45
16	9.596610	9.963102	9.633447	10.366553	44
17	9.596903	9.963108	9.633795	10.366205	43
18	9.597196	9.963054	9.634143	10.365857	42
19	9.597490	9.962999	9.634490	10.365510	41
20	9.597783	9.962945	9.634838	10.365162	40
21	9.598075	9.962892	9.635185	10.364815	39
22	9.598368	9.962836	9.635530	10.364468	38
23	9.598660	9.962781	9.635879	10.364121	37
24	9.598952	9.962726	9.636226	10.363774	36
25	9.599244	9.962672	9.636572	10.363428	35
26	9.599536	9.962617	9.636918	10.363081	34
27	9.599827	9.962562	9.637205	10.362735	33
28	9.600118	9.962507	9.637610	10.362389	32
29	9.600409	9.962453	9.637956	10.362044	31
30	9.600700	9.962398	9.638302	10.361698	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 66.

Degree 23.

M	Sine	Co-fine	Tangent	Co-tang.	
30	9.600700	9.962398	9.638302	10.361698	30
31	9.600990	9.962343	9.638647	10.361353	29
32	9.601280	9.962288	9.638992	10.361007	28
33	9.601570	9.962233	9.639337	10.360662	27
34	9.601860	9.962178	9.639682	10.360318	26
35	9.602149	9.962122	9.640027	10.359973	25
36	9.602439	9.962067	9.640371	10.359629	24
37	9.602728	9.962012	9.640716	10.359284	23
38	9.603017	9.961957	9.641060	10.358940	22
39	9.603305	9.961902	9.641404	10.358596	21
40	9.603594	9.961846	9.641747	10.358253	20
41	9.603882	9.961791	9.642091	10.357909	18
42	9.604170	9.961735	9.642434	10.357566	17
43	9.604457	9.961680	9.642777	10.357223	16
44	9.604745	9.961624	9.643120	10.356980	15
45	9.605032	9.961569	9.643463	10.356537	14
46	9.605319	9.961513	9.643806	10.356194	13
47	9.605606	9.961458	9.644148	10.355852	12
48	9.605892	9.961402	9.644490	10.355510	11
49	9.606179	9.961346	9.644832	10.355168	10
50	9.606465	9.961290	9.645174	10.354826	6
51	9.606750	9.961235	9.645516	10.354484	8
52	9.607039	9.961179	9.645857	10.354142	7
53	9.607322	9.961123	9.646199	10.353801	6
54	9.607607	9.961067	9.646540	10.353460	5
55	9.607892	9.961011	9.646881	10.353119	4
56	9.608176	9.960955	9.647222	10.352778	3
57	9.608461	9.960899	9.647562	10.352438	2
58	9.608745	9.960842	9.647903	10.352097	1
59	9.609029	9.960786	9.648243	10.351757	0
60	9.609313	9.960730	9.648583	10.351417	
	Co-fine	Sien	Co-tang.	Tangent	

Degree 66.

Degree 24.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.609313	9.960730	9.648583	10.351417	60
1	9.609597	9.960674	9.648923	10.351077	59
2	9.609880	9.960617	9.649263	10.350737	58
3	9.610163	9.960561	9.649602	10.350398	57
4	9.610446	9.960505	9.649942	10.350058	56
5	9.610729	9.960448	9.650281	10.349719	55
6	9.611012	9.960392	9.650620	10.349380	54
7	9.611294	9.960335	9.650959	10.349041	53
8	9.611576	9.960279	9.651297	10.348703	52
9	9.611858	9.960222	9.651636	10.348364	51
10	9.612140	9.960165	9.651974	10.348026	50
11	9.612421	9.960109	9.652312	10.347688	49
12	9.612702	9.960052	9.652650	10.347350	48
13	9.612983	9.959995	9.652988	10 347012	47
14	9.613264	9.959938	9.653326	10.346674	46
15	9.613545	9.959881	9.653663	10.346337	45
16	9.614825	9.959824	9.654000	10.345999	44
17	9.614105	9.959768	9.654337	10.345662	43
18	9.614385	9.959710	9.654674	10.345325	42
19	9.614665	9.959653	9.655011	10.344989	41
20	9.614944	9.959596	9.655348	10.344652	40
21	9 615223	9.959539	9.655684	10.344316	39
22	9.615502	9.959482	9.656020	10.343980	38
23	9.615781	9.959425	9.656356	10.343643	37
24	9 616060	9.959367	9.656692	10.343308	36
25	9.616.38	9.959310	9.657028	10.342972	35
26	9.616616	9 959253	9.657363	10.342636	34
27	9.616894	9.959195	9.657699	10.342301	33
28	9 617172	9.959138	9 658034	10.341966	32
26	9.617450	9.959080	9.658369	10.341531	31
30	9.617727	9.959023	9.658704	10.341296	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 65.

Degree 24.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.617727	9.959023	9.658704	10.341296	30
31	9.618004	9.958965	9.659039	10.340926	29
32	9.618281	9.958908	9.659373	10.340627	28
33	9.618558	9.958850	9.659708	10.340292	27
34	9.618834	9.958792	9.660042	10.339958	26
35	9.619110	9.958734	9.660376	10.329624	25
36	9.619386	9.958677	9.660710	10.339290	24
37	9.619662	9.958619	9.661043	10.338957	23
38	9.619938	9.958561	9.661377	10.338623	22
39	9.620213	9.958503	9.661710	10.338290	21
40	9.620488	9.958445	9.662043	10.337956	20
41	9.620763	9.958387	9.662376	10.337623	19
42	9.621038	9.958329	9.662709	10.337291	18
43	9.621313	9.958271	9.663042	10.336958	17
44	9.621587	9.958212	9.663374	10.336625	16
45	9.621861	9.958154	9.663707	10.336293	15
46	9.622135	9.958096	9.664039	10.335961	14
47	9.622409	9.958038	9.664371	10.335629	13
48	9.622682	9.957979	9.664703	10.335297	12
49	9.622956	9.957921	9.665035	10.334965	11
50	9.623229	9.957862	9.665366	10.334634	10
51	9.623502	9.957804	9.665697	10.334302	9
52	9.623776	9.957745	9.666029	10.333971	8
53	9.624047	9.957687	9.666360	10.333640	7
54	9.624319	9.957628	9.666691	10.333309	6
55	9.624591	9.957570	9.667021	10.332979	5
56	9.624863	9.957511	9.667352	10.332648	4
57	9.625134	9.957452	9.667682	10.332318	3
58	9.625406	9.957393	9.668012	10.331987	2
59	9.625677	9.957334	9.668343	10.331657	1
60	9.625948	9.957276	9.668672	10.331327	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 65.

Degree 25.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.625948	9.957276	9.668672	10.331327	60
1	9.626219	9.957217	9.669002	10.330998	59
2	9.626490	9.957158	9.669332	10.330668	58
3	9.626760	9.957099	9.669661	10.330339	57
4	9.627030	9.957040	9.669990	10.330009	56
5	9.627300	9.956981	9.670320	10.329680	55
6	9.627570	9.956922	9.670649	10.329351	54
7	9.627840	9.956862	9.670977	10.329022	53
8	9.628109	9.956803	9.671305	10.328694	52
9	9.628378	9.956744	9.671634	10.328365	51
10	9.628647	9.956684	9.671963	10.328037	50
11	9.628916	9.956625	9.672291	10.327709	49
12	9.629184	9.956565	9.672619	10.327381	48
13	9.629453	9.956506	9.672947	10.327053	47
14	9.629721	9.956446	9.673274	10.326725	46
15	9.629989	9.956387	9.673603	10.326398	45
16	9.630257	9.956327	9.673929	10.326070	44
17	9.630524	9.956267	9.674256	10.325743	43
18	9.630792	9.956208	9.674584	10.325416	42
19	9.631059	9.956148	9.674910	10.325089	41
20	9.631326	9.956088	9.675237	10.324763	40
21	9.631592	9.956029	9.675564	10.324436	39
22	9.631859	9.955969	9.675890	10.324110	38
23	9.632125	9.955909	9.676216	10.323783	37
24	9.632392	9.955849	9.676543	10.323457	36
25	9.632657	9.955789	9.676869	10.323131	35
26	9.632923	9.955739	9.677194	10.322805	34
27	9.633189	9.955669	9.677520	10.322480	33
28	9.633454	9.955609	9.677845	10.322154	32
29	9.633719	9.955548	9.678171	10.321829	31
30	9.633984	9.955488	9.678496	10.321504	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 64.

Degree 25.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.633984	9.955488	9.678496	10.321504	30
31	9.634249	9.955428	9.678821	10.321179	29
32	9.634514	9.955367	9.679146	10.320854	28
33	9.634778	9.955307	9.679471	10.320529	27
34	9.635042	9.955246	9.679795	10.320205	26
35	9.635306	9.955186	9.680120	10.319880	25
36	9.635570	9.955125	9.680444	10.319556	24
37	9.635833	9.955065	9.680768	10.319232	23
38	9.636097	9.955004	9.681092	10.318908	22
39	9.636360	9.954944	9.681416	10.318584	21
40	9.636623	9.954883	9.681740	10.318260	20
41	9.636886	9.954823	9.682063	10.317937	19
42	9.637148	9.954762	9.682386	10.317613	18
43	9.637411	9.954701	9.682710	10.317290	17
44	9.637673	9.954640	9.683033	10.316967	16
45	6.637935	9.954579	9.683356	10.316644	15
46	9.638197	9.954518	9.683678	10.316321	14
47	9.638458	9.954457	9.684001	10 315999	13
48	9.638720	9.954396	9.684324	10.315676	12
49	9.638981	9.954335	9.684646	10.315354	11
50	9.639242	9.954274	9.684968	10.315032	10
51	9.639503	9.954213	9.685290	10.314710	9
52	9.639764	9.954152	9.685612	10.314388	8
53	9.640024	9.954090	9.685934	10.314066	7
54	9.640284	9.954029	9.686255	10.313745	6
55	9.640544	9.954968	9.686577	10.313423	5
56	9.640804	9.953906	9.686898	10.313102	4
57	9.641064	9.953845	9.687219	10.312781	3
58	9.641323	9.953783	9.687540	10.312460	2
59	9.641583	9.953722	9.687861	10.312138	1
60	9.641842	9.953660	9.688182	10.311818	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 64.

Degree 26.

M	Sine.	Co-sine	Tangent	Co-tang.	
0	9.641842	9.953660	9.688182	10.311818	60
1	9.642101	9.953598	9.688502	10.311498	59
2	9.642360	9.953537	9.688823	10.311177	58
3	9.642618	9.953475	9.689143	10.310857	57
4	9.642876	9.953413	9.689463	10.310537	56
5	9.643135	9.953351	9.689783	10.310217	55
6	9.643393	9.953290	9.690103	10.309897	54
7	9.643650	9.953228	9.690423	10.309577	53
8	9.643908	9.953166	9.690742	10.309258	52
9	9.644165	9.953104	9.691063	10.308938	51
10	9.644423	9.953042	9.691381	10.308619	50
11	9.644680	9.952980	9.691700	10.308300	49
12	9.644936	9.952917	9.692019	10.307981	48
13	9.645193	9.952855	9.692338	10.307662	47
14	9.645449	9.952793	9.692656	10.307343	46
15	9.645706	9.952731	9.692975	10.307025	45
16	9.645962	9.952668	9.693293	10.306706	44
17	9.646218	9.952606	9.693612	10.306388	43
18	9.646473	9.952544	9.693930	10.306070	42
19	9.646729	9.952481	9.694248	10.305752	41
20	9.646984	9.952419	9.694566	10.305434	40
21	9.647239	9.952356	9.694883	10.305117	39
22	9.647494	9.952294	9.695201	10.304799	38
23	9.647749	9.952231	9.695518	10.304482	37
24	9.648004	9.952168	9.695835	10.304164	36
25	9.648258	9.952105	9.696153	10.303847	35
26	9.648512	9.952043	9.696470	10.303530	34
27	9.648766	9.951980	9.696786	10.303213	33
28	9.649020	9.951917	9.697103	10.302897	32
29	9.649274	9.951854	9.697420	10.302580	31
30	9.649527	9.951791	9.697738	10.302264	30
	Co-sine	Sien	Co-tang.	Tangent	M

Degree 63.

Degree 26.

	Sine	Co-sine	Tangent	Co-tang.	
	9.649527	9.951791	9.697738	10.302264	30
1	9.649781	9.951728	9.698052	10.301947	29
2	9.650034	9.951665	9.698369	10.301631	28
3	9.650287	9.951602	9.698685	10.301315	27
4	9.650539	9.951539	9.699001	10.300999	26
5	9.650798	9.951476	9.699316	10.300684	25
6	9.651044	9.951412	9.699632	10.300368	24
7	9.651296	9.951349	9.699947	10.300052	23
8	9.651548	9.951286	9.700263	10.299737	22
9	9.651800	9.951222	9.700578	10.299422	21
10	9.652052	9.951159	9.700893	10.299107	20
11	9.652303	9.951095	9.701208	10.298792	19
12	9.652555	9.951032	9.701522	10.298477	18
13	9.652806	9.950968	9.701837	10.298163	17
14	9.653057	9.950905	9.702152	10.297848	16
15	9.653307	9.950841	9.702466	10.297534	15
16	9.653558	9.950777	9.702780	10.297219	14
17	9.653808	9.950714	9.703095	10.296905	13
18	9.654059	9.950650	9.703409	10.296591	12
19	9.654309	9.950586	9.703722	10.296277	11
20	9.654558	9.950522	9.704036	10.295964	10
21	9.654808	9.950458	9.704350	10.295650	9
22	9.655057	9.950394	9.744663	10.295337	8
23	9.655307	9.950330	9.704976	10.295023	7
24	9.655556	9.950266	9.705290	10.294710	6
25	9.655805	9.950202	9.705603	10.294397	5
26	9.656053	9.950138	9.705915	10.294084	4
27	9.656302	9.950074	9.706228	10.293771	3
28	9.656550	9.950009	9.706541	10.293459	2
29	9.656799	9.949945	9.706853	10.293146	1
30	9.656347	9.949881	9.707166	10.292834	0
	Co-sine	Sine	Co-tang.	Tangent	M.

Degree 63.

Degree 27.

M	Sine	Co sine	Tangent	Co-tang.	
0	9.657047	9.949830	9.707166	10.292834	6
1	9.657295	9.949816	9.707478	10.292523	5
2	9.657542	9.949752	9.707790	10.292210	5
3	9.657790	9.949687	9.708102	10.291897	5
4	9.658037	9.949623	9.708414	10.291586	5
5	9.658284	9.949559	9.708726	10.291274	5
6	9.658531	9.949494	9.709037	10.290962	5
7	9.658777	9.949429	9.709349	10.290651	5
8	9.659024	9.949364	9.709660	10.290340	5
9	9.659271	9.949300	9.709971	10.290029	5
10	9.659517	9.949238	9.710282	10.289718	5
11	9.659763	9.949174	9.710593	10.289407	4
12	9.660009	9.949105	9.710904	10.289096	4
13	9.660255	9.949040	9.711214	10.288785	4
14	9.660500	9.948976	9.711525	10.288475	4
15	9.660746	9.948910	9.711836	10.288164	4
16	9.660991	9.948845	9.712146	10.287854	4
17	9.661236	9.948760	9.712456	10.287544	4
18	9.661481	9.948715	9.712766	10.287234	4
19	9.661726	9.948650	9.713076	10.286924	4
20	9.661970	9.948584	9.713385	10.286614	4
21	9.662214	9.948519	9.713695	10.286305	3
22	9.662459	9.948453	9.714005	10.285995	3
23	9.662702	9.948388	9.714314	10.285686	3
24	9.662947	9.998323	9.714624	10.285376	3
25	9.663190	9.948257	9.714933	10.285067	3
26	9.663433	9.948191	9.715241	10.284758	3
27	9.663677	9.948126	9.715550	10.284449	3
28	9.663920	9.948060	9.715859	10.284140	3
29	9.664164	9.947995	9.716168	10.283832	3
30	9.664406	9.947929	9.716477	10.283523	3
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 62.

Degree 27.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.664406	9.947929	9.716477	10.283523	30
1	9.664648	9.947863	9.716785	10.283215	29
2	9.664891	9.947797	9.717093	10.282907	28
3	9.665133	9.947731	9.717401	10.282598	27
4	9.665375	9.947665	9.717709	10.282290	26
5	9.665617	9.947599	9.718017	10.281983	25
6	9.665858	9.947533	9.718325	10.281675	24
7	9.666100	9.947467	9.718633	10.281367	23
8	9.666341	9.947401	9.718940	10.281060	22
9	9.666583	9.947335	9.719248	10.280752	21
10	9.666824	9.947269	9.719555	10.280445	20
11	9.667065	9.947203	9.719862	10.280138	19
12	9.667305	9.947136	9.720169	10.279831	18
13	9.667546	9.947070	9.720476	10.279524	17
14	9.667786	9.947004	9.720783	10.279217	16
15	9.668026	9.946937	9.721089	10.278911	15
16	9.668266	9.946871	9.721395	10.278604	14
17	9.668506	9.946804	9.721702	10.278298	13
18	9.668746	9.946738	9.722008	10.277991	12
19	9.668986	9.946671	9.722315	10.277685	11
20	9.669225	9.946604	9.722621	10.277379	10
21	9.669464	9.946537	9.722927	10.277073	9
22	9.669703	9.946471	9.723232	10.276768	8
23	9.669942	9.946404	9.723538	10.276462	7
24	9.670181	9.946337	9.723843	10.276156	6
25	9.670419	9.946270	9.724149	10.275851	5
26	9.670657	9.946203	9.724454	10.275546	4
27	9.670896	9.946136	9.724759	10.275240	3
28	9.671134	9.946069	9.725065	10.274935	2
29	9.671372	9.946002	9.725369	10.274630	1
30	9.671609	9.945935	9.725674	10.274326	0
	Co sine	Sine	Co-tang.	Tangent	M

Degree 62.

Degree 28.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.671609	9.945935	9.725674	10.274326	60
1	9.671847	9.945868	9.725979	10.274021	59
2	9.672084	9.945800	9.726284	10.273816	58
3	9.672321	9.945733	9.726588	10.273412	57
4	9.672558	9.945666	9.726892	10.273107	56
5	9.672795	9.945598	9.727197	10.272803	55
6	9.673032	9.945531	9.727501	10.272499	54
7	9.673268	9.945463	9.727805	10.272195	53
8	9.673505	9.945396	9.728109	10.271891	52
9	9.673741	9.945328	9.728412	10.271587	51
10	9.673977	9.945261	9.728716	10.271284	50
11	9.674213	9.945193	9.729020	10.270980	49
12	9.674448	9.945125	9.729323	10.270677	48
13	9.674684	9.945058	9.729626	10.270374	47
14	9.674919	9.944990	9.729929	10.270070	46
15	9.675154	9.944922	9.730232	10.279767	45
16	9.675389	9.944854	9.730535	10.269464	44
17	9.675623	9.944786	9.730838	10.269162	43
18	9.675859	9.944718	9.751141	10.268859	42
19	9.676094	9.944650	9.731443	10.268556	41
20	9.676328	9.944582	9.731746	10.268254	40
21	9.676562	9.944514	9.732048	10.267952	39
22	9.676796	9.944446	9.732351	10.267649	38
23	9.677030	9.944377	9.732653	10.267347	37
24	9.677264	9.944309	9.732955	10.267045	36
25	9.677497	9.944241	9.733257	10.266743	35
26	9.677731	9.944172	9.733558	10.266441	34
27	9.677964	9.944104	9.733860	10.266140	33
28	9.678197	9.944016	9.734162	10.265838	32
29	9.678430	9.943967	9.734463	10.265537	31
30	9.678663	9.943898	9.734764	10.265236	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 61.

Degree 28.

M.	Sine	Co-sine	Tangent	Co-tang.	
30	9.678663	9.943898	9.734764	10.265236	30
31	9.678895	9.943830	9.735666	10.264934	29
32	9.679128	9.943751	9.735362	10.264633	28
33	9.679360	9.943692	9.735668	10.264332	27
34	9.679592	9.943624	9.735968	10.264031	26
35	9.679824	9.943555	9.736269	10.263731	25
36	9.680056	9.943486	9.736570	10.263430	24
37	9.680288	9.943417	9.736870	10.263130	23
38	9.680519	9.943348	9.737171	10.262829	22
39	9.680750	9.943279	9.737471	10.262529	21
40	9.680982	9.943210	9.737771	10.262229	20
41	9.681213	9.943141	9.738071	10.261929	19
42	9.681443	9.943072	9.738371	10.261629	18
43	9.681674	9.943003	9.738671	10.261329	17
44	9.681904	9.942933	9.738971	10.261029	16
45	9.682135	9.942864	9.739271	10.260729	15
46	9.682365	9.942795	9.739570	10.260430	14
47	9.682595	9.942725	9.739870	10.260130	13
48	9.682825	9.942656	9.740169	10.259831	12
49	9.683055	9.942587	9.740468	10.259532	11
50	9.683284	9.942517	9.740767	10.259233	10
51	9.683514	9.942448	9.741066	10.258934	9
52	9.683743	9.942378	9.741365	10.258635	8
53	9.683972	9.942308	9.741664	10.258336	7
54	9.684201	9.942239	9.741962	10.258038	6
55	9.684430	9.942169	9.742261	10.257739	5
56	9.684658	9.942099	9.742559	10.257441	4
57	9.684887	9.942029	9.742858	10.257142	3
58	9.685115	9.941959	9.743156	10.256844	2
59	9.685343	9.941889	9.743454	10.256546	1
60	9.685571	9.941819	9.743751	10.256248	0
M.	Co-sine	Sine	Co-tang.	Tangent	M.

Degree 61.

Degree 29.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.685571	9.941819	9.743752	10.256248	60
1	9.685799	9.941749	9.744050	10.255950	59
2	9.686027	9.941679	9.744348	10.255652	58
3	9.686254	9.941609	9.744645	10.255355	57
4	9.686482	9.941539	9.744943	10.255057	56
5	9.686709	9.941468	9.745240	10.254760	55
6	9.686936	9.941398	9.745538	10.254462	54
7	9.687163	9.941328	9.745835	10.254165	53
8	9.687389	9.941257	9.746132	10.253868	52
9	9.687616	9.941187	9.746429	10.253571	51
10	9.687842	9.941116	9.746726	10.253274	50
11	9.688069	9.941046	9.747023	10.252977	49
12	9.688295	9.940975	9.747319	10.252680	48
13	9.688523	9.940905	9.747616	10.252384	47
14	9.688747	9.940834	9.747912	10.252087	46
15	9.688972	9.940763	9.748209	10.251791	45
16	9.689198	9.940693	9.748505	10.251495	44
17	9.689421	9.940622	9.748801	10.251199	43
18	9.689648	9.940551	9.749097	10.250902	42
19	9.689873	9.940480	9.749393	10.250607	41
20	9.690098	9.940409	9.749689	10.250311	40
21	9.690323	9.940338	9.749985	10.250015	39
22	9.690548	9.940267	9.750281	10.249719	38
23	9.690772	9.940196	9.750576	10.249424	37
24	9.690996	9.940125	9.750872	10.249128	36
25	9.691220	9.940053	9.751167	10.248833	35
26	9.691444	9.939982	9.751462	10.248538	34
27	9.691668	9.939911	9.751757	10.248243	33
28	9.691892	9.939840	9.752052	10.247948	32
29	9.692115	9.939768	9.752347	10.247653	31
30	9.692339	9.939697	9.752642	10.247358	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 60.

Degree 29.

M.	Sine	Co-sine	Tangent	Co-tang.	
30	9.692339	9.939697	9.752642	10.247358	30
31	9.692562	9.939625	9.752937	10.247063	29
32	9.692785	9.939554	9.753231	10.246769	28
33	9.693008	9.939482	9.753526	10.246474	27
34	9.693231	9.939410	9.753820	10.246180	26
35	9.693453	9.939339	9.754115	10.245885	25
36	9.693676	9.939267	9.754409	10.245591	24
37	9.693898	9.939195	9.754703	10.245297	23
38	9.694120	9.939125	9.754997	10.245003	22
39	9.694342	9.939051	9.755291	10.244709	21
40	9.694564	9.938980	9.755584	10.244415	20
41	9.694786	9.938908	9.755878	10.244122	19
42	9.695007	9.938835	9.756172	10.243828	18
43	9.695229	9.938763	9.756465	10.243535	17
44	9.695450	9.938691	9.756759	10.243241	16
45	9.695671	9.938619	9.757052	10.242948	15
46	9.695892	9.938547	9.757345	10.242655	14
47	9.696113	9.938475	9.757638	10.242362	13
48	9.696334	9.938402	9.757931	10.242069	12
49	9.696554	9.938330	9.758224	10.241776	11
50	9.696774	9.938257	9.758517	10.241483	10
51	9.696995	9.938185	9.758810	10.241190	9
52	9.697215	9.938112	9.759102	10.240898	8
53	9.697435	9.938040	9.759395	10.240605	7
54	9.697654	9.937967	9.759687	10.240313	6
55	9.697874	9.937895	9.759979	10.240021	5
56	9.698093	9.937822	9.760271	10.239728	4
57	9.698313	9.937749	9.760564	10.239436	3
58	9.698532	9.937676	9.760856	10.239144	2
59	9.698751	9.937603	9.761147	10.238852	1
60	9.698970	9.937531	9.761439	10.238561	0
M.	Co-sine	Sine	Co-tang.	Tangent	M.

Degree 60.

Degree 30.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.698970	9.937531	9.761439	10.238561	60
1	9.699189	9.937458	9.761731	10.238269	59
2	9.699407	9.937385	9.762023	10.237977	58
3	9.699626	9.937312	9.762314	10.237686	57
4	9.699844	9.937238	9.762606	10.237394	56
5	9.700062	9.937165	9.762897	10.237103	55
6	9.700280	9.937092	9.763188	10.236812	54
7	9.700498	9.937019	9.763479	10.236521	53
8	9.700716	9.936945	9.763770	10.236230	52
9	9.700933	9.936872	9.764061	10.235939	51
10	9.701151	9.936799	9.764352	10.235648	50
11	9.701368	9.936725	9.764643	10.235357	49
12	9.701585	9.936652	9.764933	10.235067	48
13	9.701802	9.936578	9.765224	10.234776	47
14	9.702019	9.936505	9.765514	10.234486	46
15	9.702236	9.936431	9.765805	10.234195	45
16	9.702452	9.936357	9.766095	10.233905	44
17	9.702669	9.936284	9.766385	10.233615	43
18	9.702885	9.936210	9.766675	10.233325	42
19	9.703101	9.936136	9.766965	10.233035	41
20	9.703317	9.936062	9.767255	10.232745	40
21	9.703533	9.935980	9.767545	10.232455	39
22	9.703748	9.935914	9.767834	10.232166	38
23	9.703964	9.935840	9.768124	10.231876	37
24	9.704179	9.935766	9.768413	10.231587	36
25	9.704395	9.935692	9.768703	10.231297	35
26	9.704610	9.935618	9.768992	10.231008	34
27	9.704825	9.935543	9.769281	10.230719	33
28	9.705040	9.935469	9.769570	10.230430	32
29	9.705254	9.935393	9.769859	10.230141	31
30	9.705469	9.935320	9.770148	10.229852	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 59.

Degree 30.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.705469	9.935320	9.770148	10.229852	30
31	9.705683	9.935246	9.770437	10.229563	29
32	9.705897	9.935171	9.770726	10.229274	28
33	9.706112	9.935097	9.771015	10.228985	27
34	9.706326	9.935022	9.771303	10.228697	26
35	9.706539	9.934948	9.771592	10.228408	25
36	9.706753	9.934873	9.771880	10.228120	24
37	9.706967	9.934798	9.772168	10.227832	23
38	9.707180	9.934723	9.772456	10.227543	22
39	9.707393	9.934649	9.772745	10.227255	21
40	9.707606	9.934574	9.773033	10.226967	20
41	9.707819	9.934499	9.773321	10.226679	19
42	9.708032	9.934424	9.773608	10.226391	18
43	9.708245	9.934349	9.773896	10.226104	17
44	9.708457	9.934274	9.774184	10.225816	16
45	9.708670	9.934199	9.774471	10.225529	15
46	9.708882	9.934123	9.774759	10.225241	14
47	9.709094	9.934048	9.775046	10.224951	13
48	9.709306	9.933973	9.775333	10.224666	12
49	9.709518	9.933897	9.775621	10.224379	11
50	9.709730	9.933822	9.775908	10.224092	10
51	9.709941	9.933747	9.776195	10.223805	9
52	9.710153	9.933671	9.776482	10.223518	8
53	9.710364	9.933596	9.776768	10.223232	7
54	9.710575	9.933520	9.777055	10.222945	6
55	9.710786	9.933444	9.777342	10.222658	5
56	9.710997	9.933369	9.777628	10.222372	4
57	9.711208	9.933293	9.777915	10.222085	3
58	9.711418	9.933217	9.778201	10.221799	2
59	9.711629	9.933141	9.778487	10.221513	1
60	9.711839	9.933066	9.778774	10.221226	0
M	Co-sine	Sine	Co-tang.	Tangent	M

Degree 59.

Degree 31.

M	Sine	Co-fine	Tangent	Co-tang.	
0	9.711839	9.933066	9.778774	10.221226	60
1	9.712049	9.932990	9.779060	10.220940	59
2	9.712259	9.932914	9.779346	10.220654	58
3	9.712469	9.932838	9.779632	10.220368	57
4	9.712679	9.932761	9.779918	10.220082	56
5	9.712889	9.932685	9.780203	10.219796	55
6	9.713098	9.932609	9.780489	10.219511	54
7	9.713308	9.932533	9.780775	10.219225	53
8	9.713517	9.932457	9.781060	10.218940	52
9	9.713726	9.932380	9.781346	10.218654	51
10	9.713935	9.932304	9.781631	10.218369	50
11	9.714144	9.932227	9.781916	10.218084	49
12	9.714352	9.932151	9.782202	10.217799	48
13	9.714561	9.932074	9.782486	10.217514	47
14	9.714769	9.931997	9.782771	10.217229	46
15	9.714977	9.931921	9.783056	10.216944	45
16	9.715186	9.931845	9.783341	10.216659	44
17	9.715394	9.931768	9.783626	10.216374	43
18	9.715601	9.941691	9.783910	10.216090	42
19	9.715809	9.931614	9.784195	10.215805	41
20	9.716017	9.931537	9.784479	10.215520	40
21	9.716224	9.931460	9.784764	10.215236	39
22	9.716431	9.931383	9.785048	10.214952	38
23	9.716639	9.831306	9.785332	10.214668	37
24	9.716846	9.931229	9.785616	10.214384	36
25	9.717053	9.931152	9.785900	10.244099	35
26	9.717259	9.931075	9.786184	10.213816	34
27	9.717456	9.930998	9.786468	10.213532	33
28	9.717672	9.930920	9.786752	10.213248	32
29	9.717869	9.930843	9.787036	10.212964	31
30	9.718085	9.930766	9.787319	10.212681	30
	Co-fine	Sine	Co-tang.	Tangent	M

Degree 58.

Degree 31.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.718085	9.930766	9.787319	10.212681	30
31	9.718291	9.930688	9.787603	10.212397	29
32	9.718497	9.930611	9.787886	10.212114	28
33	9.718703	9.930533	9.788170	10.211830	27
34	9.718909	9.930456	9.788453	10.211547	26
35	9.719114	9.930378	9.788736	10.211264	25
36	9.719320	9.930300	9.789019	10.210981	24
37	9.719525	9.930223	9.789302	10.210698	23
38	9.719730	9.930145	9.789585	10.210415	22
39	9.719935	9.930067	9.789868	10.210132	21
40	9.720140	9.929989	9.790151	10.209849	20
41	9.720345	9.929911	9.790433	10.209566	19
42	9.720549	9.929833	9.790716	10.209284	18
43	9.720754	9.929755	9.790999	10.209001	17
44	9.720958	9.929677	9.791281	10.208719	16
45	9.721162	9.929599	9.791563	10.208436	15
46	9.721366	9.929521	9.791846	10.208154	14
47	9.721570	9.929442	9.792128	10.207872	13
48	9.721774	9.929364	9.792410	10.207590	12
49	9.721978	9.929286	9.792692	10.207308	11
50	9.722181	9.929207	9.792974	10.207024	10
51	9.722385	9.929129	9.793256	10.206744	9
52	9.722588	9.929050	9.793538	10.206462	8
53	9.722791	9.928972	9.793819	10.206180	7
54	9.722994	9.928893	9.794101	10.205899	6
55	9.723197	9.928814	9.794383	10.205627	5
56	9.723400	9.928736	9.794664	10.205336	4
57	9.723603	9.928657	9.794945	10.205054	3
58	9.723805	9.928578	9.795227	10.204773	2
59	9.724007	9.928499	9.795508	10.204492	1
60	9.724219	9.928420	9.795789	10.204211	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 58.

Degree 32.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.724210	9.928420	9.795789	10.204211	60
1	9.724412	9.928341	9.796070	10.203930	59
2	9.724614	9.928262	9.796351	10.203649	58
3	9.724816	9.928183	9.796632	10.203368	57
4	9.725017	9.928104	9.796913	10.203087	56
5	9.725219	9.928025	9.797194	10.202806	55
6	9.725420	9.927946	9.797474	10.202522	54
7	9.725622	9.927867	9.797755	10.202245	53
8	9.725823	9.927787	9.798036	10.201964	52
9	9.726024	9.927708	9.798316	10.201684	51
10	9.726225	9.927628	9.798596	10.201404	50
11	9.726426	9.927549	9.798877	10.201123	49
12	9.726626	9.927469	9.799157	10.200843	48
13	9.726827	9.927390	9.799437	10.200563	47
14	9.727027	9.927310	9.799717	10.200283	46
15	9.727228	9.927231	9.799997	10.200003	45
16	9.727428	9.927151	9.800277	10.199723	44
17	9.727628	9.927071	9.800557	10.199443	43
18	9.727828	9.926991	9.800836	10.199163	42
19	9.728027	9.926911	9.801116	10.198884	41
20	9.728227	9.926831	9.801396	10.198604	40
21	9.728427	9.92675	9.801675	10.198325	39
22	9.728626	9.926671	9.801955	10.198045	38
23	9.728825	9.926591	9.802234	10.197766	37
24	9.729024	9.92651	9.802513	10.197487	36
25	9.729223	9.92643	9.802792	10.197207	35
26	9.729422	9.926351	9.803072	10.196928	34
27	9.729621	9.926270	9.803351	10.196649	33
28	9.729820	9.926190	9.803630	10.196370	32
29	9.730018	9.926110	9.803908	10.196091	31
30	9.730216	9.926029	9.804187	10.195813	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 57.

Degree 32.

M	Sine	Co sine	Tangent	Co-tang.	
30	9.730216	9.926079	9.804187	10.195813	30
31	9.730415	9.925949	9.904466	10.195534	29
32	9.730613	9.925868	9.804745	10.195255	28
33	9.730811	9.925787	9.805023	10.194977	27
34	9.731009	9.925707	9.805302	10.194698	26
35	9.731206	9.925626	9.805580	10.194420	25
36	9.731404	9.925545	9.805859	10.194141	24
37	9.731601	9.925464	9.806137	10.193863	23
38	9.731799	9.925384	9.806415	10.193585	22
39	9.731996	9.925303	9.806693	10.193309	21
40	9.732193	9.925222	9.806971	10.193028	20
41	9.732390	9.925141	9.807249	10.192751	19
42	9.732587	9.925060	9.807527	10.192433	18
43	9.732784	9.924978	9.807805	10.192195	17
44	9.732980	9.924897	9.808083	10.191917	16
45	9.733177	9.924816	9.808361	10.191639	15
46	9.733373	9.924735	9.808638	10.191362	14
47	9.733569	9.924652	9.808916	10.191084	13
48	9.733765	9.924572	9.809193	10.190807	12
49	9.733961	9.924491	9.809471	10.190529	11
50	9.734157	9.924409	9.809748	10.190252	10
51	9.734353	9.924328	9.810025	10.189975	9
52	9.734548	9.924246	9.810302	10.189697	8
53	9.734744	9.924164	9.810580	10.189420	7
54	9.734939	9.924083	9.810857	10.189143	6
55	9.735134	9.924001	9.811134	10.288866	5
56	9.735330	9.923919	9.811410	10.188589	4
57	9.735525	9.923837	9.811687	10.188313	3
58	9.735719	9.923755	9.811964	10.188036	2
59	9.735914	9.923673	9.812241	10.187759	1
60	9.736109	9.923591	9.812517	10.187483	0
	Co-sine	Sine	Co-tang.	Tangent	M.

Degree 57.

Degree 33.

M	Sine	Co-sine	Tangent	Co-	
0	9.736107	9.923591	9.812517	10.187483	60
1	9.736309	9.923350	9.814794	10.187206	59
2	9.736497	9.923427	9.813070	10.186930	58
3	9.736692	9.92334	9.813347	10.186653	57
4	9.736886	9.923263	9.813623	10.186377	56
5	9.737080	9.923180	9.813899	10.186101	55
6	9.737274	9.923098	9.814175	10.185824	54
7	9.737467	9.923016	9.814452	10.185548	53
8	9.737661	9.922933	9.814728	10.185272	52
9	9.737854	9.922851	9.815004	10.184996	51
10	9.738048	9.922768	9.815279	10.184720	50
11	9.738241	9.922686	9.815555	10.184445	49
12	9.738434	9.922603	9.815831	10.184169	48
13	9.738627	9.922520	9.816107	10.183893	47
14	9.738820	9.922438	9.816382	10.183617	46
15	9.739013	9.922355	9.816658	10.183342	45
16	9.739205	9.922272	9.816933	10.183066	44
17	9.739398	9.922189	9.817209	10.182791	43
18	9.739590	9.922106	9.817484	10.182516	42
19	9.739783	9.922023	9.817759	10.182240	41
20	9.739975	9.921940	9.818035	10.181965	40
21	9.740167	9.921857	9.818310	10.181690	39
22	9.740359	9.921773	9.818585	10.181415	38
23	9.740550	9.921690	9.818860	10.181140	37
24	9.740742	9.921607	9.819135	10.180865	36
25	9.740934	9.921524	9.819410	10.180590	35
26	9.741125	9.921441	9.819684	10.180315	34
27	9.741316	9.921357	9.819959	10.180041	33
28	9.741507	9.921274	9.820234	10.179766	32
29	9.741698	9.921190	9.820508	10.179492	31
30	9.741889	9.921107	9.820783	10.179217	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 56.

Degree 33.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.741889	9.922107	9.820783	10.179217	30
31	9.742080	9.921102	9.821057	10.178943	29
32	9.742271	9.920993	9.821332	10.178668	28
33	9.742461	9.920885	9.821606	10.178394	27
34	9.742652	9.920777	9.821880	10.178120	26
35	9.742842	9.920668	9.822154	10.177846	25
36	9.743032	9.920560	9.822429	10.177571	24
37	9.743223	9.920520	9.822703	10.177297	23
38	9.743412	9.920436	9.822977	10.177023	22
39	9.743602	9.920352	9.823250	10.176739	21
40	9.743792	9.920268	9.823524	10.176476	20
41	9.743982	9.920184	9.823798	10.176202	19
42	9.744171	9.920099	9.824072	10.175928	18
43	9.744361	9.920015	9.824345	10.175655	17
44	9.744550	9.919931	9.824619	10.175381	16
45	9.744739	9.919846	9.824892	10.175108	15
46	9.744928	9.919762	9.825166	10.174834	14
47	9.745117	9.919677	9.825439	10.174560	13
48	9.745306	9.919593	9.825713	10.174287	12
49	9.745494	9.919508	9.825986	10.174014	11
50	9.745683	9.919424	9.826259	10.173741	10
51	9.745871	9.919339	9.826532	10.173468	9
52	9.746059	9.919254	9.826805	10.173195	8
53	9.746248	9.919169	9.827078	10.172922	7
54	9.746436	9.919084	9.827351	10.172649	6
55	9.746624	9.918999	9.827624	10.172376	5
56	9.746811	9.918915	9.827897	10.172103	4
57	9.746999	9.918830	9.828170	10.171830	3
58	9.747187	9.918744	9.828442	10.171558	2
59	9.747374	9.918659	9.828715	10.171285	1
60	9.747562	9.918574	9.828987	10.171012	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 56.

Degree 34.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.747562	9.918574	9.828988	10.171012	60
1	9.747749	9.918489	9.829260	10.170740	59
2	9.747936	9.918404	9.829532	10.170468	58
3	9.748123	9.918318	9.829805	10.170195	57
4	9.748310	9.918233	9.830077	10.169923	56
5	9.748497	9.918147	9.830349	10.169651	55
6	9.748683	9.918062	9.830621	10.169379	54
7	9.748870	9.917976	9.830893	10.169106	53
8	9.749056	9.917891	9.831165	10.168834	52
9	9.749242	9.917805	9.831437	10.168563	51
10	9.749429	9.917719	9.831705	10.168291	50
11	9.749615	9.917634	9.831981	10.168019	49
12	9.749801	9.917548	9.832253	10.167747	48
13	9.749986	9.917462	9.832525	10.167475	47
14	9.750172	9.917376	9.832796	10.167204	46
15	9.750358	9.917290	9.833068	10.166932	45
16	9.750543	9.91720	9.833339	10.166660	44
17	9.750729	9.917118	9.833611	10.166389	43
18	9.750914	9.917032	9.833882	10.166118	42
19	9.751099	9.916945	9.834154	10.165846	41
20	9.751284	9.916859	9.834425	10.165575	40
21	9.751469	9.916773	9.834696	10.165304	39
22	9.751654	9.916686	9.834907	10.165033	38
23	9.751838	9.916600	9.835238	10.164762	37
24	9.752023	9.916514	9.835509	10.164491	36
25	9.752207	9.916427	9.835780	10.164220	35
26	9.752392	9.916341	9.836051	10.163949	34
27	9.752576	9.916254	9.836322	10.163678	33
28	9.752760	9.916167	9.836593	10.163407	32
29	9.752944	9.916080	9.836864	10.163136	31
30	9.753128	9.915994	9.837134	10.162866	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 55.

Degree 34.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.753128	9.915994	9.837134	10.126866	30
31	9.753312	9.915907	9.837405	10.162595	29
32	9.753495	9.915820	9.837675	10.162325	28
33	9.753679	9.915733	9.837946	10.162054	27
34	9.753862	9.915646	9.838216	10.161784	26
35	9.754046	9.915559	9.838487	10.161513	25
36	9.754229	9.915472	9.838757	10.161243	24
37	9.754412	9.915385	9.839027	10.160973	23
38	9.754595	9.915297	9.839297	10.160702	22
39	9.754778	9.915210	9.839568	10.160432	21
40	9.754960	9.915123	9.839838	10.160162	20
41	9.755143	9.915035	9.840108	10.159892	19
42	9.755325	9.914948	9.840378	10.159622	18
43	9.755508	9.914860	9.840647	10.159352	17
44	9.755690	9.914773	9.840917	10.159083	16
45	9.755872	9.914685	9.841187	10.158813	15
46	9.756054	9.914597	9.841457	10.158543	14
47	9.756236	9.914510	9.841726	10.158273	13
48	9.756418	9.914422	9.841996	10.158004	12
49	9.756600	9.914334	9.842266	10.157734	11
50	9.756781	9.914246	9.842535	10.157465	10
51	9.756963	9.914158	9.842804	10.157195	9
52	9.757144	9.914070	9.843074	10.146926	8
53	9.757326	9.913982	9.843343	10.156657	7
54	9.757507	9.913894	9.843612	10.156387	6
55	9.757688	9.913806	9.843882	10.156118	5
56	9.757869	9.913718	9.844151	10.155849	4
57	9.758049	9.913630	9.844420	10.155580	3
58	9.758230	9.913542	9.844689	10.155311	2
59	9.758411	9.913453	9.844958	10.155042	1
60	9.758591	9.913364	9.845227	10.154774	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 55.

Degree 35.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.758591	9.913364	9.845227	10.154771	60
1	9.758772	9.913276	9.845496	10.154504	59
2	9.758952	9.913187	9.845764	10.154235	58
3	9.759132	9.913099	9.846033	10.153967	57
4	9.759312	9.913010	9.846302	10.153698	56
5	9.759492	9.912921	9.846570	10.153429	55
6	9.759672	9.912832	9.846839	10.153161	54
7	9.759851	9.912744	9.847107	10.152892	53
8	9.760031	9.912655	9.847376	10.152624	52
9	9.760210	9.912566	9.847644	10.152356	51
10	9.760390	9.912477	9.847913	10.152087	50
11	9.760569	9.912388	9.848181	10.151819	49
12	9.760748	9.912299	9.848449	10.151551	48
13	9.760927	9.912210	9.848717	10.151283	47
14	9.761106	9.912121	9.848985	10.151015	46
15	9.761285	9.912031	9.849254	10.150746	45
16	9.761464	9.911942	9.849522	10.150478	44
17	9.761642	9.911853	9.849789	10.150215	43
18	9.761821	9.911763	9.850057	10.149943	42
19	9.761999	9.911674	9.850325	10.149675	41
20	9.762177	9.911584	9.840593	10.149407	40
21	9.762356	9.911495	9.850861	10.149139	39
22	9.762534	9.911405	9.851128	10.148872	38
23	9.762712	9.911315	9.851396	10.148604	37
24	9.762889	9.911226	9.851664	10.148336	36
25	9.763067	9.911136	9.851931	10.148069	35
26	9.763245	9.911046	9.852199	10.147801	34
27	9.763422	9.910956	9.852466	10.147534	33
28	9.763599	9.910866	9.852733	10.147267	32
29	9.763777	9.910776	9.853001	10.146999	31
30	9.763954	9.910686	9.853268	10.146732	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 54.

Degree 35.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.763954	9.910680	9.853268	10.146732	30
31	9.764131	9.910590	9.853532	10.146465	29
32	9.764306	9.910501	9.853802	10.146198	28
33	9.764485	9.910411	9.854069	10.145930	27
34	9.764662	9.910325	9.854336	10.145664	26
35	9.764838	9.910235	9.854603	10.145397	25
36	9.765015	9.910144	9.854870	10.145130	24
37	9.765191	9.910054	9.855137	10.144863	23
38	9.765367	9.909963	9.855404	10.144596	22
39	9.765544	9.909873	9.855671	10.144329	21
40	9.765720	9.909782	9.855937	10.144063	20
41	9.765896	9.909691	9.856204	10.143796	19
42	9.766071	9.909601	9.856471	10.143529	18
43	9.766247	9.909510	9.856737	10.143263	17
44	9.766423	9.909419	9.857004	10.142996	16
45	9.766598	9.909328	9.857270	10.142730	15
46	9.766774	9.909237	9.857537	10.142463	14
47	9.766949	9.909146	9.857803	10.142197	13
48	9.767124	9.909055	9.858069	10.141931	12
49	9.767299	9.908964	9.858336	10.141664	11
50	9.767474	9.908873	9.858602	10.141398	10
51	9.767649	9.908781	9.858868	10.141132	9
52	9.767824	9.908690	9.859134	10.140866	8
53	9.767997	9.908598	9.859400	10.140600	7
54	9.768173	9.908507	9.859666	10.140334	6
55	9.768348	9.908416	9.859932	10.140068	5
56	9.768522	9.908324	9.860198	10.139802	4
57	9.768696	9.908233	9.860464	10.139536	3
58	9.768871	9.908141	9.860730	10.139270	2
59	9.769045	9.908049	9.860995	10.139005	1
60	9.769219	9.907958	9.861261	10.138739	0
M	Co-sine	Sine	Co-tang.	Tangent	M

Degree 54.

Degree 36.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.769219	9.907958	9.861261	10.138739	60
1	9.769392	9.907866	9.861527	10.138473	59
2	9.769566	9.907774	9.861792	10.138208	58
3	9.769740	9.907682	9.862058	10.137942	57
4	9.769913	9.907590	9.862323	10.137677	56
5	9.770087	9.907498	9.862589	10.137411	55
6	9.770260	9.907406	9.862854	10.137146	54
7	9.770433	9.907314	9.863119	10.136880	53
8	9.770606	9.907221	9.863385	10.136615	52
9	9.770779	9.907129	9.863650	10.136350	51
10	9.770952	9.907037	9.863915	10.136085	50
11	9.771125	9.906945	9.864180	10.135820	49
12	9.771298	9.906852	9.864445	10.135554	48
13	9.771470	9.906760	9.864710	10.135289	47
14	9.771643	9.906667	9.864975	10.135024	46
15	9.771815	9.906574	9.865240	10.134759	45
16	9.771987	9.906482	9.865505	10.134495	44
17	9.772159	9.906389	9.865770	10.134230	43
18	9.772331	9.906296	9.866035	10.133965	42
19	9.772503	9.906203	9.866300	10.133700	41
20	9.772675	9.906111	9.866564	10.133436	40
21	9.772847	9.906018	9.866829	10.133171	39
22	9.773018	9.905925	9.867094	10.132906	38
23	9.773190	9.905832	9.867358	10.132642	37
24	9.773361	9.905738	9.867623	10.132377	36
25	9.773533	9.905645	9.867887	10.132113	35
26	9.773704	9.905552	9.868152	10.131848	34
27	9.773875	9.905459	9.868416	10.131584	33
28	9.774046	9.905365	9.868680	10.131320	32
29	9.774217	9.905272	9.868945	10.131055	31
30	9.774388	9.905179	9.869209	10.130791	30
M	Co-sine	Sine	Co-tang.	Tangent	M

Degree 53.

Degree 36.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.774388	9.905179	9.869209	10.130791	30
31	9.774558	9 905085	9.864773	10.130527	29
32	9.774729	9.904992	9.867327	10.130263	28
33	9 774899	9.904898	9.870001	10.129999	27
34	9.775070	9.904804	9.870265	10.129735	26
35	9.775240	9.904711	9.870529	10.129471	25
36	9.775410	9.904617	9.870793	10.129207	24
37	9.775580	9.904523	9.871057	10.128943	23
38	9 775750	9.904429	9.871321	10.128679	22
39	9.775920	9.904335	9.871585	10.128415	21
40	9.776090	9.904241	9.871849	10.128151	20
41	9.776259	9.904147	9.872112	10.127888	19
42	9.776429	9.904053	9.872376	10.127624	18
43	9.776598	9.903959	9.872640	10.127360	17
44	9.776768	9.903864	9.872903	10.127097	16
45	9.776937	9.903770	9.873167	10.126833	15
46	9.777106	9.903676	9.873430	10.126570	14
47	9.777275	9.903581	9.873694	10.126306	13
48	9.777444	9.903486	9.873957	10.126043	12
49	9.777613	9.903392	9.874220	10.125780	11
50	9.777781	9.903298	9.874484	10.125516	10
51	9.777950	9.903203	9.874747	10.125253	9
52	9.778119	9.903108	9.875010	10.124990	8
53	9.778287	9 903013	9.875273	10.124727	7
54	9.778455	9.902919	9.875536	10.124464	6
55	9.778623	9.902824	9.875799	10.124201	5
56	9.778792	9.902729	9.876063	10.123937	4
57	9.778960	9.902634	9.876326	10.123674	3
58	9.779129	9.902539	9.876589	10.123411	2
59	9.779295	9.902444	9.876851	10.123149	1
60	9.779463	9.902349	9.877114	10.122885	0
M	Co-sine	Sine	Co-tang.	Tangent	M

Degree 53.

Degree 37.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.779463	9.902349	9.877114	10.122385	60
1	9.779631	9.902254	9.877377	10.122623	59
2	9.779798	9.902158	9.877640	10.122360	58
3	9.779965	9.902063	9.877903	10.122097	57
4	9.780133	9.901967	9.878165	10.121834	56
5	9.780300	9.901872	9.878428	10.121572	55
6	9.780467	9.901776	9.878691	10.121309	54
7	9.780634	9.901681	9.878953	10.121047	53
8	9.780801	9.901585	9.879216	10.120784	52
9	9.780968	9.901488	9.879478	10.120522	51
10	9.781134	9.901391	9.879741	10.120259	50
11	9.781301	9.901298	9.880003	10.119997	49
12	9.781467	9.901202	9.880265	10.119734	48
13	9.781634	9.901106	9.880528	10.119472	47
14	9.781800	9.901010	9.880790	10.119210	46
15	9.781966	9.900914	9.881052	10.118948	45
16	9.782132	9.900828	9.881314	10.118686	44
17	9.782298	9.900722	9.881576	10.118424	43
18	9.782464	9.900626	9.881839	10.118161	42
19	9.782630	9.900529	9.882101	10.117899	41
20	9.782796	9.900433	9.882363	10.117637	40
21	9.782961	9.900337	9.882625	10.117375	39
22	9.783127	9.900240	9.882886	10.117114	38
23	9.783292	9.900144	9.883148	10.116852	37
24	9.783457	9.900047	9.883410	10.116590	36
25	9.783623	9.899951	9.883672	10.116328	35
26	9.783788	9.899854	9.883934	10.116066	34
27	9.783953	9.899757	9.884195	10.115805	33
28	9.784118	9.899660	9.884457	10.115543	32
29	9.784282	9.899563	9.884719	10.115281	31
30	9.784447	9.899467	9.884980	10.115020	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 52.

Degree 37.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9 784447	9.899467	9.884980	10.115020	30
31	9.784616	9.899370	9.885242	10.114758	29
32	9.784776	9.899273	9.885503	10.114497	28
33	9 784941	9.899175	9.885765	10.114235	27
34	9 785105	9.899078	9.886026	10.113974	26
35	9.785269	9.898981	9.886288	10.113712	25
36	9.785433	9.898884	9.886549	10.113451	24
37	9.785591	9.898787	9.886810	10.113190	23
38	9.785761	9.898689	9.887072	10.112928	22
39	9.785925	9.898592	9.887333	10.112667	21
40	9 786088	9.898494	9.887594	10.112406	20
41	9.786252	9.898397	9.887855	10.112145	18
42	9.786416	9.898299	9.888116	10.111884	17
43	9.786579	9.898201	9.888377	10.111623	16
44	9.786742	9.898104	9.888638	10.111362	15
45	9.786909	9.898006	9.888899	10.111101	
46	9.787069	9.897908	9.889160	10.110840	14
47	9.787232	9.897810	9.889421	10.110579	13
48	9.787395	9.897712	9.889682	10 110318	12
49	9.787557	9.897614	9.889943	10.110057	11
50	9 787720	9.897516	9.890204	10.109796	10
51	9.787883	9.897418	9.890465	10.109535	9
52	9.788045	9.897320	9.890725	10.109275	8
53	9.788208	9.897222	9.890986	10.109014	7
54	9.788370	9.897123	9.891247	10.108753	6
55	9 788532	9.897025	9.891507	10.108493	5
56	9.788694	9.896926	9.891768	10.108232	4
57	9.788856	9.896828	9.892028	10.107972	3
58	9.789018	9.896729	9.892289	10.107711	2
59	9.789180	9.896631	9.892549	10.107451	1
60	9.789342	9.896532	9.892810	10 107190	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 52.

Degree 38.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.789312	9.896532	9.892810	10.107190	60
1	9.789504	9.896433	9.893070	10.106930	59
2	9.789665	9.896335	9.893330	10.106669	58
3	9.789827	9.896236	9.893591	10.106409	57
4	9.789988	9.896137	9.893851	10.106149	56
5	9.790149	9.896038	9.894111	10.105889	55
6	9.790310	9.895939	9.894371	10.105628	54
7	9.790471	9.895840	9.894632	10.105368	53
8	9.790632	9.895741	9.894892	10.105108	52
9	9.790793	9.895641	9.895152	10.104848	51
10	9.790954	9.895542	9.895412	10.104588	50
11	9.791115	9.895443	9.895672	10.104328	49
12	9.791275	9.895343	9.895932	10.104068	48
13	9.791436	9.895244	9.896192	10.103808	47
14	9.791596	9.895144	9.896452	10.103548	46
15	9.791756	9.895045	9.896712	10.103288	45
16	9.791917	9.894945	9.896971	10.103028	44
17	9.792077	9.894846	9.897231	10.102769	43
18	9.792237	9.894746	9.897491	10.102509	42
19	9.792397	9.894646	9.897751	10.102249	41
20	9.792557	9.894546	9.898010	10.101990	40
21	9.792716	9.894446	9.898270	10.101730	39
22	9.792876	9.894346	9.898530	10.101470	38
23	9.793035	9.894246	9.898789	10.101211	37
24	9.793195	9.894146	9.899049	10.100951	36
25	9.793354	9.894046	9.899308	10.100692	35
26	9.793513	9.893946	9.899568	10.100432	34
27	9.793673	9.893845	9.899827	10.100173	33
28	9.793832	9.893745	9.900086	10.099913	32
29	9.793991	9.893645	9.900346	10.099654	31
30	9.794149	9.893544	9.900605	10.099395	30
M	Co-sine	Sine	Co-tang.	Tangent	M

Degree 51.

Degree 38.

Sine	Co-sine	Tangent	Co-tang.	
9.794149	9.893544	9.900605	10.099395	30
9.794308	9.893443	9.900864	10.099135	29
9.794467	9.893343	9.901124	10.098876	28
9.794626	9.893243	9.901383	10.098617	27
9.794784	9.893142	9.901642	10.098358	26
9.794942	9.893041	9.901901	10.098099	25
9.795101	9.892940	9.902160	10.097839	24
9.795259	9.892839	9.902419	10.097580	23
9.795417	9.892738	9.902678	10.097321	22
9.795575	9.892637	9.902937	10.097062	21
9.795733	9.892536	9.903196	10.096803	20
9.795891	9.892435	9.903455	10.096544	19
9.796049	9.892334	9.903714	10.096285	18
9.796206	9.892233	9.903973	10.096027	17
9.796364	9.892132	9.904232	10.095768	16
9.796521	9.892030	9.904491	10.095509	15
9.796678	9.891929	9.904750	10.095250	14
9.796836	9.891827	9.905008	10.094991	13
9.796992	9.891726	9.905267	10.094733	12
9.797150	9.891624	9.905526	10.094474	11
9.797307	9.891522	9.905784	10.094215	10
9.797464	9.891421	9.906043	10.093957	9
9.797621	9.891319	9.906302	10.093698	8
9.797777	9.891217	9.906560	10.093440	7
9.797934	9.891115	9.906819	10.093181	6
9.798091	9.891013	9.907077	10.092923	5
9.798247	9.890911	9.907336	10.092664	4
9.798403	9.890809	9.907594	10.092406	3
9.798560	9.890707	9.907852	10.092147	2
9.798716	9.890605	9.908111	10.091889	1
9.798872	9.890503	9.908369	10.091631	0
Co-sine	Sine	Co-tang.	Tangent	

Degree 51.

Degree 39.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.798872	9.890503	9.9 8369	10 091631	6
1	9.799028	9.890400	9.908627	10.091373	5
2	9.799184	9.890298	9.908886	10.091114	5
3	9.799339	9.890195	9 909144	10.090856	5
4	9.799495	9.890093	9.909402	10.090598	5
5	9.799651	9.889990	9.9096 0	10.090340	5
6	9.799806	9 889888	9.909918	10.090081	5
7	9 799961	9 889785	9.910176	10.089823	5
8	9.800117	9.889682	9.910435	10.089565	5
9	9.800272	9.889579	9.910693	10.089307	5
10	9.800427	0.889476	9.910951	10.089049	5
11	9.800582	9.889374	9.911209	10.088791	4
12	9.800737	9.889271	9.911467	10.088533	4
13	9.800892	9.889167	9.911724	10.088275	4
14	9.801047	9.889064	9.911982	10.088017	4
15	9.801201	9.888961	9.912240	10.087760	4
16	9.801356	9.888858	9.912498	10.087502	4
17	9.801510	9.888755	9.912756	10.087244	4
18	9.801665	9.888651	9.913014	10.086986	4
19	9.801819	9.888548	9.913271	10.086729	4
20	9.801973	9. 888444	9.913529	10.086471	4
21	9.802127	9.888341	9.913787	10.086213	3
22	9.802282	9.888237	9.914044	10.085956	3
23	9.802435	9.888133	9.914302	10.085698	3
24	9.802589	9.888030	9.914560	10.085440	3
25	9.802743	9.887926	9.614817	10.085183	3
26	9.802897	9.887822	9.915075	10.084925	3
27	9.803050	9.887718	9.915332	10.084668	3
28	9.803204	9.887614	9.915590	10.084410	3
29	9.803357	9.887510	9.915847	10.084153	3
30	9.803510	9.887406	9.916104	10.083895	3
	Co-sine	Sine	Co-tang.	Tangent	

Degree 5.

Degree 39.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.803510	9.887406	9.916104	10.083895	30
31	9.803664	9.887302	9.916362	10.083638	29
32	9.803817	9.887198	9.916619	10.083381	28
33	9.803970	9.887093	9.916876	10.083123	27
34	9.804123	9.886989	9.917134	10.082866	26
35	9.804276	9.886884	9.917391	10.082609	25
36	9.804428	9.886780	9.917648	10.082352	24
37	9.804581	9.886675	9.917905	10.082094	23
38	9.804734	9.886571	9.918162	10.081837	22
39	9.804886	9.886466	9.918420	10.081580	21
40	9.805038	9.886361	9.918677	10.081323	20
41	9.805191	9.886257	9.918934	10.081066	19
42	9.805343	9.886152	9.919191	10.080809	18
43	9.805495	9.886047	9.919448	10.080552	17
44	9.805647	9.885942	9.919705	10.080295	16
45	9.805799	9.885837	9.919962	10.080038	15
46	9.805951	9.885732	9.920219	10.079781	14
47	9.806103	9.885627	9.920476	10.079524	13
48	9.806254	9.885521	9.920733	10.079267	12
49	9.806406	9.885416	9.920990	10.079010	11
50	9.806557	9.685311	9.921247	10.078753	10
51	9.806709	9.885205	9.921503	10.078496	9
52	9.806860	9.885100	9.921760	10.078240	8
53	9.807011	9.884994	9.922017	10.077983	7
54	9.807162	9.884889	9.922274	10.077726	6
55	9.807313	9.884783	9.922530	10.077469	5
56	9.807464	9.884677	9.922787	10.077213	4
57	9.807615	9.884572	9.923044	10.076956	3
58	9.807766	9.884466	9.923300	10.076699	2
59	9.807917	9.884360	9.923557	10.076443	1
60	9.808067	9.884254	9.923813	10.076186	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 50.

Degree 40.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.808067	9.884254	9.923813	10 076186	6
1	9.808218	9.884148	9.924070	10.075930	5
2	9.808368	9.884042	9.924327	10.075673	5
3	9.808519	9.883936	9.924583	10.075417	5
4	9.808669	9.883829	9.924839	10.075160	5
5	9.808819	9.883723	9.925096	10.074904	5
6	9.808969	9.883617	9.925352	10.074647	5
7	9.809119	9.883510	9.925609	10.074391	5
8	9.809269	9.883404	9.925865	10.074135	5
9	9.809419	9.883297	9.926121	10.073878	5
10	9.809569	9.883191	9.926378	10.073622	5
11	9.809718	9.883084	9.926634	10.073366	4
12	9.809868	9.882977	9.926890	10.073110	4
13	9.810017	9.882871	9.927147	10.072853	4
14	9.810166	9.882764	9.927403	10.072597	4
15	9.810316	9.882657	9.927659	10.072341	4
16	9.810465	9.882550	9.927915	10.072085	4
17	9.810614	9.882443	9.928171	10.071829	4
18	9.810763	9.882336	9.928427	10.071573	4
19	9.810912	9.882228	9.928683	10.071316	4
20	9.811061	9.882121	9.928940	10.071060	4
21	9.811210	9.882014	9.929196	10.070804	3
22	9.811358	9.881907	9.929452	10.070548	3
23	9.811506	9.881799	9.929708	10.070292	3
24	9.811655	9.881692	9.929964	10.070036	3
25	9.811804	9.881584	9.930219	10.069781	3
26	9.811952	9.881477	9.930475	10.069525	3
27	9.812100	9.881369	9.930731	10.069269	3
28	9.812248	9.881261	9.930987	10.069013	3
29	9.812396	9.881153	9.931243	10.068757	3
30	9.812544	9.881045	9.931499	10.068501	3
	Co-sine	Sine	Co-tang.	Tangent	

Degree 49.

Degree 40.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.812544	9.881045	9.931499	10.068501	30
31	9.812692	9.880937	9.931755	10.068245	29
32	9.812840	9.880829	9.932010	10.067989	28
33	9.812988	9.880722	9.932266	10.067734	27
34	9.813135	9.880613	9.932522	10.067478	26
35	9.813283	9.880505	9.932778	10.067222	25
36	9.813430	9.880397	9.933033	10.066967	24
37	9.813573	9.880289	9.933289	10.066711	23
38	9.813725	9.880180	9.933545	10.066455	22
39	9.813872	9.880072	9.933800	10.066200	21
40	9.814019	9.879963	9.934056	10.065944	20
41	9.814166	9.879855	9.934311	10.065688	19
42	9.814313	9.879746	9.934567	10.065433	18
43	9.814460	9.879637	9.934822	10.065177	17
44	9.814607	9.879529	9.935078	10.064922	16
45	9.814753	9.879420	9.935333	10.064666	15
46	9.814900	9.879311	9.935589	10.064411	14
47	9.815046	9.879202	9.935844	10.064156	13
48	9.815193	9.879093	9.936100	10.063900	12
49	9.815339	9.878984	9.936355	10.063645	11
50	9.815485	9.878875	9.936610	10.063389	10
51	9.815631	9.878766	9.936866	10.063134	9
52	9.815777	9.878656	9.937121	10.062879	8
53	9.815923	9.878547	9.937376	10.062623	7
54	9.816069	9.878438	9.937632	10.062368	6
55	9.816215	9.878328	9.937887	10.062113	5
56	9.816361	9.878219	9.938142	10.061858	4
57	9.816506	9.878109	9.938397	10.061602	3
58	9.816652	9.877999	9.938653	10.061347	2
59	9.816797	9.877890	9.938908	10.061092	1
60	9.816943	9.877780	9.939163	10.060837	0
M	Co-sine	Sine	Co-tang.	Tangent	M

Degree 49.

Degree 41.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.816943	9.877780	9.939163	10.060837	60
1	9.817088	9.877670	9.939418	10.060582	59
2	9.817232	9.877560	9.939673	10.060327	58
3	9.817378	9.877450	9.939928	10.060072	57
4	9.817523	9.877340	9.940183	10.059816	56
5	9.817668	9.877230	9.940438	10.059562	55
6	9.817813	9.877120	9.940693	10.059307	54
7	9.817958	9.877009	9.940948	10.059052	53
8	9.818103	9.876899	9.941203	10.058797	52
9	9.818247	9.876789	9.941458	10.058542	51
10	9.818392	9.876678	9.941713	10.058287	50
11	9.818536	9.876568	9.941968	10.058032	49
12	9.818681	9.876457	9.942223	10.057777	48
13	9.818825	9.876347	9.942478	10.057522	47
14	9.818969	9.876236	9.942733	10.057267	46
15	9.819113	9.876125	9.942988	10.057012	45
16	9.819257	9.876014	9.943243	10.056757	44
17	9.819401	9.875904	9.943498	10.056502	43
18	9.819545	9.875793	9.943752	10.056248	42
19	9.819689	9.875682	9.944007	10.055993	41
20	9.819832	9.875571	9.944262	10.055738	40
21	9.819976	9.875459	9.944517	10.055483	39
22	9.820119	9.875348	9.944771	10.055229	38
23	9.820263	9.875237	9.945026	10.054974	37
24	9.820406	9.875125	9.945281	10.054719	36
25	9.820549	9.875014	9.945535	10.054464	35
26	9.820693	9.874903	9.945790	10.054210	34
27	9.820836	9.874791	9.946045	10.053955	33
28	9.820979	9.874679	9.946299	10.053701	32
29	9.821122	9.875568	9.946554	10.053446	31
30	9.821264	9.874456	9.946808	10.053192	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 48.

Degree 47.

	Sine	Co-sine	Tangent	Co-tang.	
0	9.821264	9.874456	9.946808	10.053192	30
1	9.821407	9.874363	9.947063	10.052937	29
2	9.821550	9.874217	9.947317	10.052682	28
3	9.821692	9.874172	9.947572	10.052428	27
4	9.821835	9.874026	9.947826	10.052173	26
5	9.821977	9.873896	9.948081	10.051919	25
6	9.822120	9.873784	9.948335	10.051664	24
7	9.822262	9.873672	9.948590	10.051410	23
8	9.822404	9.873560	9.948844	10.011156	22
9	9.822546	9.873447	9.949099	10.050901	21
10	9.822688	9.873335	9.949353	10 050647	20
11	9.822830	9.873223	9.949607	10.050393	19
12	9.822972	9.873110	9.949862	10.050138	18
13	9.823114	9.872998	9.950116	10.049884	17
14	9.823255	9.872885	9.950370	10.049630	16
15	9.823397	9.872772	9.950625	10.049375	15
16	9.823538	9.872659	9.950879	10.049121	14
17	9.823680	9.872546	9.951233	10.048867	13
18	9.823821	9.872434	9.951388	10.048612	12
19	9 823962	9.872321	9.951642	10.048358	11
20	9.824104	9.872208	9.951896	10.048104	10
21	9.8 4245	9.872094	9.952150	10.047850	9
22	9.824386	9.871981	9.952404	10.047575	8
23	9.824527	9.871868	9.952659	10.047341	7
24	9.824667	9.871755	9.952913	10.047 87	6
25	9.824808	9.871641	9.95 167	10.046833	5
26	9.82494.9	9.871528	9.953421	10.046579	4
27	9.825090	9.871414	9.953675	10.046 25	3
28	9.825230	9.871301	9.953929	10.0 6071	2
29	9 825370	9.871187	9.954183	10 045817	1
30	9.825511	9.87107	9.954437	10.045562	0
	Co-sine	Sine	Co-tang	Tangent	M

Degree 48.

Degree 42.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.825511	9.871073	9.954437	10.045562	60
1	9.825651	9.870960	9.954691	10.045308	59
2	9.825791	9.870846	9.954945	10.045054	58
3	9.825931	9.870732	9.955199	10.044800	57
4	9.826071	9.870618	9.955453	10.044546	56
5	9.826211	9.870504	9.955707	10.044292	55
6	9.826351	9.870390	9.955961	10.044038	54
7	9.826491	9.870275	9.956215	10.043784	53
8	9.826631	9.870161	9.956469	10.043531	52
9	9.826770	9.870047	9.956723	10.043276	51
10	9.826910	9.869933	9.956977	10.043023	50
11	9.827049	9.869818	9.957231	10.042769	49
12	9.827189	9.869704	9.957485	10.042515	48
13	9.827328	9.869589	9.957739	10.042261	47
14	9.827467	9.869474	9.957993	10.042007	46
15	9.827606	9.869360	9.958246	10.041753	45
16	9.827745	9.869245	9.958500	10.041500	44
17	9.827884	9.869130	9.958754	10.041246	43
18	9.828023	9.869015	9.959008	10.040992	42
19	9.828162	9.868900	9.959262	10.040738	41
20	9.828301	9.868785	9.959515	10.040485	40
21	9.828439	9.868670	9.959769	10.040231	39
22	9.828578	9.868555	9.960023	10.039977	38
23	9.828716	9.868439	9.960277	10.039723	37
24	9.828855	9.868324	9.960530	10.039469	36
25	9.828993	9.868209	9.960784	10.039216	35
26	9.829131	9.868094	9.961038	10.038962	34
27	9.829269	9.867978	9.961291	10.038708	33
28	9.829407	9.867862	9.961545	10.038455	32
29	9.829545	9.867747	9.961799	10.038201	31
30	9.829683	9.867631	9.962052	10.037947	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 47.

Degree 42.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.829683	9.867631	9.962052	10.037947	30
31	9.829821	9.867515	9.962306	10.037694	29
32	9.829959	9.867399	9.962560	10.037440	28
33	9.830096	9.867283	9.962813	10.037187	27
34	9.830234	9.867167	9.963067	10.036933	26
35	9.830372	9.867051	9.963320	10.036680	25
36	9.830509	9.866935	9.963574	10.036426	24
37	9.830646	9.866819	9.963827	10.036173	23
38	9.830784	9.866703	9.964081	10.035919	22
39	9.830921	9.866586	9.964335	10.035665	21
40	9.831058	9.866470	9.964588	10 035412	20
41	9.831195	9.866353	9.964842	10.035158	19
42	9.831332	9.866237	9.965095	10.034905	18
43	9.831469	9.866120	9.965348	10.034652	17
44	9.831606	9.866004	9.965602	10.034398	16
45	9.831742	9.865887	9.965855	10.034144	15
46	9.831879	9.865770	9.966109	10.033891	14
47	9.832015	9.865653	9.966362	10.033638	13
48	9.832152	9.865536	9.966616	10.033384	12
49	9.832288	9.865419	9.966869	10.033131	11
50	9.832425	9.865302	9.967122	10.032878	10
51	9.832561	9.865185	9.967376	10.032624	9
52	9.832697	9.865068	9.967629	10.032371	8
53	9.832833	9.864950	9.967883	10.032117	7
54	9.832969	9.864833	9.968136	10.031864	6
55	9.833105	9.864716	9.968389	10.031611	5
56	9.833241	9.864598	9.968643	10.031357	4
57	9.833376	9.864480	9.968896	10.031104	3
58	9.833512	9.864362	9.969149	10.030851	2
59	9.833648	9.864244	9.969403	10.030597	1
60	9.833783	9.864127	9.969656	10.030344	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 47.

Degree 43.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.823783	9.864127	9.969656	10.030344	60
1	9.833919	9.864010	9.969909	10.030091	59
2	9.834054	9.863892	9.970162	10.029838	58
3	9.834189	9.863774	9.970416	10.029584	57
4	9.834324	9.863656	9.970669	10.029331	56
5	9.834460	9.863537	9.970922	10.029078	55
6	9.834595	9.863419	9.971175	10.028825	54
7	9.834730	9.863301	9.971428	10.028572	53
8	9.834865	9.863183	9.971682	10.028318	52
9	9.834999	9.863064	9.971935	10.028065	51
10	9.835134	9.862946	9.972188	10.027812	50
11	9.835269	9.862827	9.972441	10.027559	49
12	9.835403	9.862709	9.972694	20.027306	48
13	9.835538	9.862590	9.972948	10.027052	47
14	9.835672	9.862471	9.973201	10.026799	46
15	9.835806	9.862353	9.973454	10.026546	45
16	9.835941	9.862234	9.973707	10.026293	44
17	9.836075	9.862115	9.973960	10.026040	43
18	9.836209	9.861996	9.974213	10.025787	42
19	9.836343	9.861877	9.974466	10.025533	41
20	9.836477	9.861757	9.974719	10.025280	40
21	9.836611	9.861638	9.974973	10.025027	39
22	9.836745	9.861519	9.975226	10.024774	38
23	9.836878	9.861399	9.975479	10.024521	37
24	9.837012	9.861280	9.975732	10.024268	36
25	9.837146	9.861161	9.975985	10.024015	35
26	9.837279	9.861041	9.976238	10.023762	34
27	9.837412	9.860921	9.976491	10.023509	33
28	9.837546	9.860802	9.976744	10.023256	32
29	9.837679	9.860682	9.976997	10.023003	31
30	9.837812	9.860562	9.977250	10.022750	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 46.

Degree 43.

	Sine	Co-sine	Tangent	Co-tang.	
	.837812	9.86056	9.977250	10.022750	30
	9.837945	9.860422	9.977503	10.022497	29
	9.838078	9.860322	9.977756	10.022244	28
	9.838211	9.860202	9.978009	10.021991	27
	9.838344	9.860082	9.978262	10.021738	26
	9.838477	9.859962	9.978515	10.021485	25
	9.838609	9.859842	9.978768	10.021232	24
	9.838742	9.859721	9.979021	10.020979	23
	9.838875	9.859601	9.979274	10.020726	22
	9.839007	9.859480	9.979527	10.020473	21
	9.839140	9.859360	9.979780	10.020220	20
	9.839272	9.859239	9.980033	10.019967	19
	9.839404	9.859118	9.980285	10.019714	18
	9.839536	9.858998	9.980538	10.019461	17
	9.839668	9.858877	9.980791	10.019209	16
	9.839800	9.858756	9.981044	10.018956	15
	9.839932	9.858635	9.981297	10.018703	14
	9.840064	9.858514	9.981550	10.018450	13
	9.840196	9.858393	9.981803	10.018197	12
	9.840328	9.858272	9.982056	10.017944	11
	9.840459	9.858150	9.982309	10.017691	10
	9.840591	9.858029	9.982562	10.017438	9
	9.840722	9.857907	9.982814	10.017185	8
	9.840854	9.857786	9.983067	10.016933	7
	9.840985	9.857665	9.983320	10.016680	6
	9.841116	9.857543	9.983573	10.016427	5
	9.841247	9.857421	9.983826	10.016174	4
	9.841378	9.857300	9.984079	10.015921	3
	9.841509	9.857178	9.984331	10.015668	2
	9.841640	9.857056	9.984584	10.015416	1
	9.841771	9.856934	9.984837	10.015163	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 46.

Degree 44.

M	Sine	Co-sine	Tangent	Co-tang.	
0	9.841771	9.856934	9.984837	10.015162	60
1	9.841902	9.856812	9.985090	10.014910	59
2	9.842033	9.856690	9.985343	10.014657	58
3	9.842163	9.856568	9.985596	10.014404	57
4	9.842294	9.856445	9.985848	10.014151	56
5	9.842424	9.856323	9.986101	10.013899	55
6	9.842555	9.856201	9.986354	10.013646	54
7	9.842685	9.856078	9.986607	10.013393	53
8	9.842815	9.855956	9.986859	10.013140	52
9	9.842945	9.855833	9.987112	10.012888	51
10	9.843076	9.855710	9.987365	10.012635	50
11	9.843206	9.855588	9.987618	10.012382	49
12	9.843336	9.855465	9.987871	10.012129	48
13	9.843465	9.855342	9.988123	10.011877	47
14	9.843595	9.855219	9.988376	10.011624	46
15	9.843725	9.855096	9.988629	10.011371	45
16	9.843855	9.854973	9.988882	10.011118	44
17	9.843984	9.854850	9.989134	10.010866	43
18	9.844114	9.854727	9.989387	10.010613	42
19	9.844243	9.854603	9.989640	10.010360	41
20	9.844372	9.854480	9.989893	10.010107	40
21	9.844502	9.854356	9.990145	10.009855	39
22	9.844631	9.854233	9.990398	10.009602	38
23	9.844760	9.854109	9.990651	10.009349	37
24	9.844889	9.853986	9.990903	10.009096	36
25	9.845018	9.853862	9.991156	10.008844	35
26	9.845147	9.853738	9.991409	10.008591	34
27	9.845276	9.853614	9.991662	10.008338	33
28	9.845404	9.853490	9.991914	10.008086	32
29	9.845533	9.853366	9.992167	10.007833	31
30	9.845662	9.853242	9.992420	10.007580	30
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 45.

Degree 44.

M	Sine	Co-sine	Tangent	Co-tang.	
30	9.845662	9.853242	9.992420	10.007580	30
31	9.845790	9.853118	9.992672	10.007328	29
32	9.845919	9.852994	9.992925	10.007075	28
33	9.846047	9.852869	9.993178	10.006822	27
34	9.846175	9.852745	9.993430	10.006569	26
35	9.846304	9.852620	9.993683	10.006317	25
36	9.846432	9.852496	9.993936	10.006064	24
37	9.846560	9.852371	9.994189	10.005811	23
38	9.846688	9.852246	9.994441	10.005559	22
39	9.846816	9.852122	9.994694	10.005306	21
40	9.846944	9.851997	9.994947	10.005053	20
41	9.847071	9.851872	9.995199	10.004801	19
42	9.847199	9.851747	9.995452	10.004548	18
43	9.847327	9.851622	9.995705	10.004295	17
44	9.847454	9.851497	9.995957	10.004043	16
45	9.847582	9.851372	9.996210	10.003790	15
46	9.847709	9.851246	9.996463	10.003537	14
47	9.847836	9.851121	9.996715	10.003285	13
48	9.847964	9.850996	9.996968	10.003032	12
49	9.848091	9.850870	9.997220	10.002779	11
50	9.848218	9.850745	9.997473	10.002527	10
51	9.848345	9.850619	9.997726	10.002274	9
52	9.848472	9.850493	9.997979	10.002021	8
53	9.848599	9.850367	9.998231	10.001769	7
54	9.848726	9.850242	9.998484	10.001516	6
55	9.848852	9.850116	9.998737	10.001263	5
56	9.848979	9.849990	9.998989	10.001011	4
57	9.849106	9.849864	9.999242	10.000758	3
58	9.849232	9.849737	9.999495	10.000505	2
59	9.849359	9.849611	9.999747	10.000253	1
60	9.849485	9.849485	10.000000	10.000000	0
	Co-sine	Sine	Co-tang.	Tangent	M

Degree 45.

A most useful Table, whereby the true time of the Night may be known to a minute, without knowing the Meridian, height, or distance of the ✳.

Stars names that never set, and will be under the Pole Star.	*right asc. in time under the Pole ✳*	*d. in t. bet. the pole ✳ & pole*	*Azimuth under Pole ✳*	*From Mer.*	*Magnitude*
	h ′ ″	′ ″	o ′ ″		
1 *Cassiopeias* hip--	12,38,01	00, 07	00,01,00	E	3
2 ---- her knee ---	13 08,33	03, 25	00,30,30	E	3
3 In *Perseus* side--	15,15,39	14, 40	02,21,30	E	2
4 Great Bears lip	20,13,11	09, 19	01,43,20	E	4
5 In his left knee	21,16,04	11, 59	01,51,30	E	3
6 Lower leader	22,53,21	11, 08	01,33,40	E	2
7 Upper i'th'wain	22,55,42	12, 07	01,29,30	E	2
8 The lower in □	23,42,52	06, 26	00,57,00	E	2
9 The upper -----	00,01,23	02, 05	00,35,20	E	2
10 Rump or Aliot	00,39,18	00, 18	00,02,30	W	2
11 Last but one tayl	01,07,09	03, 40	00,25,00	W	2
12 Last of the tayl	01,29,05	05, 40	00,55,00	W	2
13 Last turn of Dr.	01,48,12	10, 52	01,14,40	W	2
14 Upper guard l.B.	02,24,32	26, 06	02,01,50	W	2
15 Lower of lit. B.	02,58,42	26, 38	02,22,12	W	3
16 Br. ✳ Drag. hea	05,25,26	43, 17	03,42 44	W	2
17 Upp. turn of D	06,38,11	34, 54	03,51,20	W	3
18 *Cepheus* left sho.	08,43,06	27, 20	03,10,20	W	2
19 In his Girdle ---	08,55,04	24, 43	03,04,40	W	3
20 Right knee -----	11,10,02	17, 3	01,21,40	W	3
21 *Cassiopeas* chair	11,41,37	10, 21	00,48,20	W	3
22. In her breast ---	12,20,56	01, 32	00,15,20	W	3

	♈ H	♋ H	Com. parts. ′ ″	diff. ″		♉ H	♌ H	Com. parts ′ ″	diff. ″
1	0	11	3.40	222		1	13	55.25	230
2	0	12	7.20	220		1	13	59.15	231
3	0	12	11.10	220		2	14	3.06	231
4	0	12	14.40	220		2	14	6.57	232
5	0	12	18.20	220		2	14	10.49	233
6	0	12	22.00	220		2	14	14.42	233
7	0	12	25.41	221		2	14	88.35	234
8	0	12	29.22	221			14	22.29	234
9	0	12	33.03	221		2	14	26.23	235
10	0	12	36.44	221		2	14	30.18	236
11	0	12	40.25	222		2	14	34.14	237
12	0	12	44.07	222		2	14	38.11	237
13	0	12	47.49	222		2	14	42.08	238
14	0	12	51.31	222		2	14	46.06	239
15	0	12	55.13	223		2	14	50.05	239
16	0	12	58.56	223		2	14	54.04	241
17	1	13	2.39	223		2	14	58.05	241
18	1	13	6.22	224		3	15	2.06	241
19	1	13	10.06	224		3	15	6.07	243
20	1	13	13.50	224		3	15	10.10	243
21	1	13	17.34	225		3	15	14.13	244
22	1	13	21.19	225		3	15	18.17	244
23	1	13	25.04	226		3	15	22.21	245
24	1	13	28 50	226		3	15	26.26	246
25	1	13	32.36	227		3	15	30.32	247
26	1	13	36.23	227		3	15	34.39	248
27	1	13	40.10	228		3	15	38.47	248
28	1	13	43.58	229		3	15	42.55	249
29	1	13	47.47	229		3	15	47.04	249
30	1	13	51.36			3	15	51.13	

	♊ H	♐ H	Com. parts. ′ ″	diff. ″		♑	♒	Com parts ′ ″	diff. ′
1	3	15	55.24	251		6	18	4.22	262
2	3	15	59.35	252		6	18	8.43	262
3	4	16	3.46	250		6	18	13.05	262
4	4	16	7.58	253		6	18	17.27	261
5	4	16	12.11	253		6	18	21.48	261
6	4	16	16.25	254		6	18	26.09	261
7	4	16	20.39	255		6	18	30.30	261
8	4	16	24.53	255		6	18	34.51	260
9	4	16	29.09	256		6	18	39.11	260
10	4	16	33.24	256		6	18	43.31	260
11	4	16	37.41	257		6	18	47.51	260
12	4	16	41.57	257		6	18	52.11	260
13	4	16	46.15	258		6	18	56.31	259
14	4	16	50.32	258		7	19	0.50	259
15	4	16	54.51	259		7	19	5.09	258
16	4	16	59.09	259		7	19	9.27	258
17	5	17	3.28	260		7	19	13.45	257
18	5	17	7.48	260		7	19	18.02	257
19	5	17	12.08	260		7	19	22.19	257
20	5	17	16.28	260		7	19	26.35	256
21	5	17	20.48	260		7	19	30.51	255
22	5	17	25.09	261		7	19	35.06	255
23	5	17	29.30	261		7	19	39.21	254
24	5	17	33.51	261		7	19	43.35	253
25	5	17	38.12	261		7	19	47.48	253
26	5	17	42.33	262		7	19	52.01	252
27	5	17	46.55	262		7	19	56.13	252
28	5	17	51.17	262		8	20	00.25	251
29	5	17	55.38	262		8	20	4.36	250
30	6	18	0.00			8	20	8.46	

A Table of the Suns Right Ascension in Time.

	☊ H	♒ H	Com. parts. ″	diff. ″	♍ H	♓ H	Com. parts. ″	diff. ″
—	—	—	—	249	—	—	—	228
1	8	20	12.55	248	10	22	12.13	228
2	8	20	17.04	248	10	22	16.01	228
3	8	20	21.12	248	10	22	19.49	227
4	8	20	25.20	247	10	22	23.36	227
5	8	20	29.27	246	10	22	27.23	226
—	—	—	—	245	—	—	—	226
6	8	20	33.33	244	10	22	31.09	225
7	8	20	37.38	244	10	22	34.55	225
8	8	20	41.42	244	10	22	38.40	225
9	8	20	45.46	243	10	22	42.25	224
10	8	20	49.50	242	10	22	46.10	224
—	—	—	—	240	—	—	—	223
11	8	20	53.53	240	10	22	49.54	223
12	8	20	57.55	239	10	22	53.38	223
13	9	21	1.55	239	10	22	57.21	222
14	9	21	5.55	239	11	23	1.04	222
15	9	21	9.54	238	11	23	4.47	222
—	—	—	—	237	—	—	—	221
16	9	21	13.53	237	11	23	8.29	221
17	9	21	17.51	236	11	23	12.11	221
18	9	21	21.48	236	11	23	15.53	220
19	9	21	25.45	235	11	23	19.34	220
20	9	21	29.41	234	11	23	23.15	220
—	—	—	—	234	—	—	—	220
21	9	21	33.36	233	11	23	26.56	220
22	9	21	37.30	233	11	23	30.37	220
23	9	21	41.24	232	11	23	34.18	220
24	9	21	45.17	232	11	23	37.59	220
25	9	21	49.10	231	11	23	41.39	219
—	—	—	—	230	—	—	—	219
26	9	21	53.02	230	11	23	45.19	219
27	9	21	56.53	229	11	23	48.59	219
28	10	22	0.44	229	11	23	52.39	220
29	10	22	4.34	228	11	23	56.20	220
30	10	22	8.24	228	12	24	00.00	219

A Table of the Longitudes, Latitudes, Right Ascension, Declination of 100 of the most Notable Stars for Anno 1680. with the Difference for every Ten Years.

Mag.	Names of the Stars.	Longitude	Latitude.
		° ′ ″	° ′ ″
2	In the head of *Andr.*	♈ 09.52.09	25.42.10 N
2	In her Girdle ——	♈ 25.54.06	25.58.30 N
2	In her Souther foot	♉ 09.44.50	27.47.10 N
1	In *Aquar.* Fomahant	♒ 29. 9.49	20.59.40 S
3	In his right shoulder	♒ 28.55.03	10.42 15 N
3	In his left shoulder	♒ 18.56.33	08.42 15 N
5	In his left hand -----	♒ 11.56.33	04.50.15 N
2	Br. ✳ in *Aqui. vul.*	♑ 27.15.23	29.20.40 N
4	1. Horn ♈ ——	♈ 28.42.33	07.08.00 N
4	2. Horn of ♈	♈ 29.28.33	08.28.30 N
3	Bright ✳ in *Aries*	♉ 03.11.32	09.56.30 N
1	*Capella*	♊ 17.23.08	22.51.45 N
2	In his right shoulder	♊ 25.28.28	21.25.40 N
1	Bootes, *Arcturus*	♎ 19.47.33	31.00.40 N
3	In his left shoulder	♎ 14.13.33	49.51.40 N
neb	*Cancer, Præsepe* -----	♋ 02.51.29	01.14.30 N
4	*Canc.* the Nor. *Asell.*	♋ 03.01.59	03.08.30 N
4	The Southern *Asell*	♋ 04 12.59	00.03.30 N
1	The G. dog ✳ *Sirius*	♋ 09.47.53	39.32.05 S
2	The L. d. ✳ *Procion*	♋ 21.23.22	15.57.10 S
3	*Capric.* the fore horn	♑ 29.27.32	07.03 11 N
3	the lower horn	♑ 29.49.33	04.42.10 N
3	former in the tayl	♒ 17.23.33	02.24.50 S
3	later in the tayl	♒ 19.09.33	02.27.50 S
3	*Cass.* br. ✳ i' th' chair	♉ 00.38.53	51.17.10 N
3	Brig. ✳ in her breast	♉ 03.22.33	46.36.50 N
3	In the *bend* of her *hip*	♉ 09. 2.33	48.47.50 N
3	In her knee ——	♉ 13.26.03	46.22 50 N
3	*Cepheus* in his Girdle	♉ 01.19.33	71.08.30 N
2	*Cete* the Whale's jaw	♉ 09.52.23	12.36.50 S
3	In the belly North	♈ 17.31.21	20.17.20 S
3	The Nor. in the tayl	♓ 26.29.53	09.58.10 S
2	The Southern ——	♓ 28.02.33	20.43.40 S
2	Nor. Cr. the bright ✳	♏ 07.45.36	44.25.20 N

r. asc. in d.	r. asc. in ti.	Declination	dif. r. a.	dif. dec. 10 y.
o ′ ″	h ′ ″	o ′ ″	h′ ″	′ ″
357.58.44	23.51.55	27 20.38 N	0.31	03. 24 A
12.54.44	0.51.39	33.56. 4 N	0.33	03. 18 A
26.04.03	1.44.16	40.46. 0 N	0.35	03. 00 A
339.54.00	22.39.36	31.14.10 S	0.34	03. 00 S
327.20.55	21.49.24	1.49.32 S	0.22	02. 54 S
318.39.42	21.14.39	6.53.58 S	0.32	0 . 36 S
307.30.42	20.30.03	10.37.32 S	0.30	01. 54 S
293.47.23	19.35. 9	8. 3.56 N	0.14	01. 18 A
24.00.26	1.36. 2	17.42.12 N	0.33	03. 07 A
24.12.39	1.36.55	19.12.42 N	0.33	02. 51 A
27.18.58	1.49.16	21.55.30 N	0.34	03. 00 A
73.09.08	4.52.36	45.38.00 N	0.33	01. 00 A
84.06.06	5.36 24	44.50.40 N	0.47	00. 25 A
210.18.50	14. 1.15	20.53.56 N	0.28	02. 57 S
214.50.09	14.19.21	39.10.36 N	0.25	02. 41 S
125.28.26	8.21.54	20.46.52 N	0.35	01. 54 S
126.08.00	8.24.32	22.35.00 N	0.36	02. 00 S
126.36.32	8.26.26	19.19.00 N	0.35	01. 00 S
97.43.42	6.30.55	16.17.18 S	0.27	00. 24 A
110.38.32	7.22.34	6. 1.36 N	0.32	01. 12 S
300.07.34	20. 0.30	13.25.18 S	0.34	01. 36 S
310.50.05	20. 3.20	15.41.26 S	0.35	01. 42 S
320.39.17	21.22.37	17.59.33 S	0.34	02. 36 S
322.26.30	21.29.46	17.27 46 S	0 34	02. 42 S
357.59.33	23.51.58	57.35.28 N	0.30	03. 24 A
5.39.36	0.22.38	54.48.28 N	0.33	03. 24 A
9.28.24	0.37.54	59. 0.48 N	0.34	03. 24 A
16.17.00	1.05. 8	58 33.46 N	02.38	02. 18 A
321. 2.06	21.24. 8	69.11.56 N	8 39	02. 36 A
41.23.07	2 45.32	2.48 50 N	0 30	02. 30 A
23 57.00	1.35.48	11.51.02 S	0.30	03. 06 S
0.48 36	0. 3.14	10.31.50 S	0 31	03. 30 S
6.59 44	0.27.59	19.42.32 S	0.31	03. 24 S
230.26.00	15.21.44	27.49.32 N	0.26	02. 06 S

A Table of the Longitudes, Latitudes, Right Ascension, Declination of 100 of the most Notable Stars for Anno 1680, with the Difference for every Ten Years.

Mag.	Names of the Stars.	Longitude	Latitude
		o "	o ' "
3	In the Swans bill -	♑ 26 48.37	49.03.00 N
3	In her breſt - - -	♒ 20.28.37	57.10.20 N
2	In her tayle - - -	♓ 00.58.18	59.57.20 N
3	In her upper wing -	♒ 11.57.53	64.25.50 N
3	In her lower - - -	♒ 23.14.22	49.27.00 N
3	Bright ✳ in *Draco*	♐ 23.29.13	75.02.10 N
2	*Gemini*'s head of *Ca.*	♋ 15.44.53	10.02.50 N
2	*Gem.* head of *Pollux*	♋ 18.47.59	06.38.30 N
2	In the bright foot	♋ 04.34.53	06.48.00 S
3	*Hercules* his Head -	♐ 11.41.13	37.22.15 N
3	In his right ſhoulder	♏ 26.37.43	42.47.15 N
3	In his left ſhoulder	♐ 10.20.13	47.46.15 N
1	*Hydra*'s Heart - -	♌ 22.49.43	22.23.50 S
1	*Lyons* Heart - - -	♌ 25.21.38	00.26.20 N
1	*Lyons* Tayle - - -	♍ 17.09.53	12.16.20 N
2	*Ly.* br. ✳ in his creſt	♌ 25.01.25	08.45.40 N
2	*Ly.* br. ✳ in his loins	♍ 06.50.38	14.18.30 N
3	*Ly.* i'th' top of's neck	♌ 22.59.53	11.48.40 N
3	*Ly.* below in his neck	♌ 23.22.23	04.50.40 N
3	In the back o'th *hare*	♊ 15.12.13	43.55.50 S
2	Northern Ballance	♏ 14.55.23	08.33.30 N
2	Southern Ballance -	♏ 10.39.33	00.25.10 N
1	Bright ſtar i'th' *harp*	♑ 10.49.33	61.47.00 N
3	I'th' head of *Ophiu*	♐ 18.00.13	35.56 15 N
3	In his left hand - -	♏ 27.54 43	17.18.20 N
3	In his right knee - -	♐ 13.34.13	07.17.20 N
3	In his left knee - -	♐ 04.49.13	11.29.20 N
3	In his right ſhoulder	♐ 20.55.13	28.00.20 N
4	*Ori.* i'th' top of his h.	♊ 19.17.53	13.25.30 S
2	*Orions* right ſhoulder	♊ 24.19.41	16.06.15 S
2	In his left ſhoulder	♊ 16.29.53	16.52.30 S
1	*Orions* Foot *Rigel*	♊ 12.19.0	31.10 10 S
2	Firſt of his belt - -	♊ 17.52.33	23.36.40 S
2	Second of his belt	♊ 18.56.48	24.34.10 S

r. asc. in d.	r. as. in ti.	Declination	dif. r. a.	dif. dec. 10 y.
o ′ ″	h ′ ″	o ′ ″	h′ ″	′ ″
289.27.36	19.17.50	27.20.28 N	0.24	01.06 A
302.45.10	20.11.01	39.16.39 N	0.21	01.48 A
307.37.06	20.30.28	44.10.46 N	0.20	02.03 A
293 51.26	19.35.26	44.23.33 N	0.29	01.24 A
308.17.10	20.33.09	32.47.12 N	0.24	02.06 A
267.18.20	17.49.13	51.29.26 N	0.14	00.12 S
108.29.58	07.14.00	32.32.38 N	0.41	01.06 S
111.25.18	07.25.41	28.45.26 N	0.38	01.12 S
094.45.56	06.19 04	16.37.56 N	0.35	00.12 S
255.01.52	17.00.07	14.48.44 N	0.27	00.18 S
244.06.35	16.16.26	22.15.40 N	0.26	01.00 S
255.26.19	17.01.45	25.17.24 N	0.21	00.48 S
137.57.22	09.11.49	07.16 30 S	0.30	02.30 A
147.47.45	09.51.11	13.30.58 N	0.33	02.51 S
173.09.46	11.32.39	16.20.52 N	0.31	03.24 S
150.31.41	10.02.07	21.26.48 N	0.34	02.54 S
164.14.55	10.57.00	22.14.32 N	0.35	03.24 S
149.41.16	09.58.45	24.59.42 N	0.35	02.54 S
147.30.16	09.50.01	18.19.09 N	0.35	02.48 S
078.38.30	05.14.34	21.00.13 S	0.26	00.42 S
224.59.02	14.59.56	08.09.58 S	0.32	00.24 A
218.21.44	14.33.27	14.39.54 S	0.33	00.42 A
276.29.32	18.25.58	38.31.28 N	0.20	00.24 A
260.01.26	17.20.06	12.51.46 N	0.28	00.42 S
239.31.01	15.58.04	02. 9.16 S	0.33	01.48 A
252.55.46	16.51.43	15.14.30 S	0.30	01.30 A
244.55.01	16.19.40	19.50.30 S	0.33	01.00 A
261.54.02	17.27.36	04.43.46 N	0.33	00.30 S
079.24.45	05.17.39	09.42.14 N	0.33	00.42 A
084.26.40	05.37.47	07.17.32 N	0.33	00.24 A
077.00.52	05.08.03	06.01.26 N	0.31	00.48 A
074 47.44	04.59.11	08.35.36 S	0.30	00.57 S
078.54.24	05.15.37	00.34.14 S	0.31	00.42 S
079.57.27	05.19.50	01.26.58 S	1.31	00.36 S

A Table of the Longitudes, Latitudes, Right Ascentions, Declination of 100 of the most Notable Stars for Anno 1680. with the Difference for every Ten Years.

Mag.	Names of the Stars.	Longitude			Latitude		
		°	′	″	°	′	″
2	The 3d in *Orion*'s belt	♊ 20	06	03	25	21	10 S
3	*Pegasus* in his mouth	♒ 27	28	17	22	06	20 N
2	In his thigh, *sheat*	♓ 24	57	13	31	08	20 N
2	Bright ✳ in the wing	♓ 19	02	43	19	24	50 N
2	Br. ✳ i' th' lower w.	♈ 04	43	13	12	37	10 N
2	*Perseus* in his rde --	♉ 27	17	01	30	05	50 N
3	*Caput Medusæ* ———	♉ 21	49	03	22	22	40 N
4	Southern fish *occiput*	♓ 16	56	05	07	17	00 N
3	Bright ✳ betwixt ♓	♈ 24	53	05	09	04	00 S
4	*Sagittar.* in his head	♑ 09	05	33	01	45	10 N
1	*Scorpion*'s heart - --	♐ 05	18	33	04	26	30 S
2	In his forehead *north*	♏ 28	40	03	01	06	55 N
3	In his foreh. middle	♏ 28	03	13	01	52	40 S
3	In his forehead South	♏ 28	28	53	05	20	40 S
2	*Serpents* neck br. ✳	♏ 17	33	53	25	33	50 N
1	*Bulls* eye South - --	♊ 05	18	36	05	30	50 S
2	*Bulls* Northern eye	♊ 03	59	06	02	36	10 S
3	The lowest of *Hiades*	♊ 01	17	08	05	46	20 S
2	His Northern horn	♊ 18	05	53	05	20	30 N
3	His Southern horn	♊ 20	18	53	02	13	30 S
3	Brightest of the 7 ✳	♉ 25	37	42	03	59	00 N
1	Virgin Spike	♍ 19	22	53	01	59	30 S
3	Br. ✳ in her Girdle	♍ 07	01	53	08	40	30 N
3	*Vindimiatrix* ———	♍ 05	28	23	16	15	00 N
2	Great Bears shoulder	♌ 10	41	32	49	40	10 N
2	Next under it ———	♌ 14	51	03	45	05	40 N
2	Br. ✳ hinder thigh	♌ 25	57	33	47	08	40 N
3	Bright ✳ on his back	♌ 26	33	03	51	37	10 N
2	In his Rump Aliot	♍ 04	19	33	54	17	45 N
2	Middle in the tayl	♍ 11	04	59	56	21	10 N
2	Last in the tayl - - -	♍ 22	20	13	54	24	10 N
2	The Pole Star ———	♊ 24	09	53	65	59	50 N
2	Little Bears shoulder	♌ 08	28	12	72	48	40 N

r.asc. in d.	r.as. in ti.	Declination	dif.r.a.	dif.dec. 10 y
o ″ ′	h ′ ″	o ′ ″	h′ ″	′ ″
081.03.12	05.24.13	02.09.20 S	0.30	00.30 S
322.12.00	21.28.48	08.27.02 N	0.31	02.36 A
342.06.12	22.48.25	26.22.09 N	0.29	03.09 A
343.13.08	22.48.52	13.29.29 N	0.30	03.09 A
359.12.12	23.56.49	13.26.08 N	0.20	03.24 A
045.04.42	03.00.19	48.39.42 N	0.35	02.36 A
041.53.18	02.47.33	39.41.30 N	0.39	02.30 A
345.08.40	23.00.35	01.33.26 N	0.39	03.18 A
026.22.38	01.45.30	01.13.00 N	0.32	03.00 A
279.47.37	18.39.10	21.24.24 S	0 47	00.48 S
242.29.04	16.09.56	25.36.42 S	0.37	01.36 A
236.40.51	15.46.43	18 49 48 S	0.35	01.54 A
235.19.35	15.43.06	21.37.40 S	0.36	02.00 A
2234.8.31	15.39 54	25.05.42 S	0.39	02.06 A
32.09. 00	15.28.36	07.20.24 N	0.30	02.06 S
064 24.16	04.17.37	15.50.10 N	0.34	01.30 A
062.26.48	04 09.47	18.33.52 N	0.34	01.42 A
060.22.25	04.01.30	14.49.02 N	0.34	01.42 A
076.31.54	05.06.07	28.20.38 N	0.39	00.48 A
079.37.18	05.18.29	20.57.22 N	0.36	00.32 A
052.09.49	03.28.39	23.03.36 N	0.35	02.06 A
197.06.57	13 08.28	09.27.00 S	0.31	03.15 A
189.54.46	12.39.39	05.09.42 N	0.31	05.24 S
191.36.56	12.46.27	12.41.34 N	0.31	93.18 S
160.56.52	10.43.47	63.28.26 N	0.40	03.12 S
160.32.55	10.42.11	58.05.26 N	0.39	03.12 S
174.06.58	11.36.27	55.30.06 N	0.33	03.12 S
179.52.01	11.59.28	58.47.06 N	0.32	03.12 S
189.54.08	12.39.36	57.43.24 N	0.27	03.18 S
197.42.26	13.10.50	56.37.16 N	0.25	03.12 S
203.41.25	13.34.46	50.57.08 N	0.24	03.06 S
009.14.10	00.36.57	87.36.03 N	1.16	02.24 A
222.40.05	14.50.40	75.38.00 N	0.01	00.15 A

A Table of Accounts.

	1 farthing	2 farthings	3 farthings
	li. sh. d. q.	li. sh. d. q.	li. sh. d. q.
1	1	2	3
2	2	1. 0	1. 2
3	3	1. 2	2. 1
4	1. 0	2. 0	3. 0
5	1. 1	2. 2	3. 3
6	1. 2	3. 0	4. 2
7	1. 3	3. 2	5. 1
8	2. 0	4. 0	6. 0
9	2. 1	4. 2	6. 3
10	2. 2	5. 0	7. 2
20	5. 0	10. 0	1. 3. 0
30	7. 2	1. 3. 0	1. 10. 2
40	10. 0	1. 8. 0	2. 6. 0
50	1. 0. 2	2. 1. 0	3. 1. 2
60	1. 0. 3	2. 6. 0	3. 9. 0
70	1. 5. 2	2. 11. 0	4. 4. 2
80	1. 8. 0	3. 4. 0	5. 0. 0
90	1. 10. 2	3. 9. 0	5. 7. 2
100	2. 1. 0	4. 2. 0	6. 3. 0
200	4. 2. 0	8. 4. 0	12. 6. 0
300	6. 3. 0	12. 6. 0	18. 9. 0
400	8. 4. 0	16. 8. 0	1. 5. 0. 0
500	10. 5. 0	1. 0. 10. 0	1. 11. 3. 0
600	12. 6. 0	1. 5. 0. 0	1. 17. 6. 0
700	14. 7. 0	1. 9. 2. 0	2. 3. 9. 0
800	16. 8. 0	1. 13. 4. 0	2. 10. 0. 0
900	18. 9. 0	1. 17. 6. 0	2. 16. 3. 0
1000	1. 0. 10. 0	2. 1. 8. 0	3. 2. 6. 0
2000	2. 1. 8. 0	4. 3. 4. 0	6. 5. 0. 0
5000	5. 4. 2. 0	10. 8. 4. 0	15. 12. 6. 0
10000	10. 8. 4. 0	20. 16. 8. 0	31. 5. 0. 0

A Table of Accounts.

	1 penny	2 pence	3 pence	4 pence
	li sh. d.	li. sh. d.	li. sh. d.	li. sh. d.
	1	2	3	4
1	2	4	6	8
2	3	6	9	1. 0
3	4	8	1. 0	1. 4
4	5	10	1. 3	1. 8
5	6	1. 0	1. 6	2. 0
6	7	1. 2	1. 9	2. 4
7	8	1. 4	2. 0	2. 8
8	9	1. 6	2. 3	3. 0
9	10	1. 8	2. 6	3. 4
10	1. 8	3. 4	5. 0	6. 8
20	2. 6	5. 0	7. 6	10. 0
30	3. 4	6. 8	10. 0	13. 4
40	4. 2	8. 4	12. 6	16. 8
50	5. 0	10. 0	15. 0	1. 0. 0
60	5.10	11. 8	17. 6	1. 3. 4
70	6. 8	13. 4	1. 0. 0	1. 6. 8
80	7. 6	15. 0	1. 2. 6	1.10. 0
90	8. 4	16. 8	1. 5. 0	1.13. 4
100	16. 8	1. 13. 4	2.10. 0	3. 6. 8
200	1. 5. 0	2. 10. 0	3.15. 0	5. 0. 0
300	1. 13. 4	3. 6. 8	5. 0. 0	6.13. 4
400	2. 1. 8	4. 3. 4	6. 5. 0	8. 6. 8
500	2. 10. 0	5. 0. 0	7.10. 0	10. 0. 0
600	2. 18. 4	5. 16. 8	08.15.0	11.13. 4
700	3. 6. 8	6. 13. 4	10. 0. 0	13. 6. 8
800	3. 15. 0	7. 10. 0	11. 5. 0	15. 0. 0
900	4. 3. 4	8. 6. 8	12.10.0	16.13. 4
000	8. 6. 8	16. 13. 4	25. 0. 0	33. 6. 8
000	20. 16. 8	41. 13. 4	62.10. 0	83. 6. 8
000	41. 13. 4	83. 6. 8	125. 0. 0	166.13 .

A Table of Accounts

	5 pence	6 pence	7 pence	8 pen
	li. sh. d.	li. sh. d.	li. sh. d.	li. sh.
1	5	6	7	
2	10	1. 0	1. 2	1.
3	1. 3	1. 6	1. 9	2
4	1. 8	2. 0	2. 4	2
5	2. 1	2. 6	2.11	3
6	2. 6	3. 0	3. 6	4
7	2.11	3. 6	4. 1	4
8	3. 4	4. 0	4. 8	5
9	3. 9	4. 6	5. 3	6
10	4. 2	5. 0	5.10	6
20	8. 4	10. 0	11. 8	13
30	12. 6	15. 0	17. 6	1. 0
40	16. 8	1. 0. 0	1. 3. 4	1. 6
50	1. 0. 0	1 5. 0	1. 9. 2	1 13
60	1. 5. 0	1.10. 0	1.12. 0	2. 0
70	1. 9. 2	1.15. 0	2. 0.10	2. 6
80	1 13. 4	2. 0. 0	2. 6. 8	2.13
90	1.17 6	2. 5. 0	2.12. 6	3. 0
100	2. 1. 8	2.10. 0	2.18. 4	3. 6
200	4. 3. 4	5. 0. 0	5.16. 8	6.13
300	6. 5. 0	7.10 0	8.15. 0	10. 0
400	8. 6. 8	10. 0. 0	11.13. 4	13. 6
500	10. 8. 4	12.10. 0	14.11. 8	16.13
600	12.10. 0	15. 0. 0	17.10. 0	20. 0
700	14.11. 8	17.10. 0	20. 8. 4	23. 6
800	16.13. 4	20. 0. 0	23. 6. 8	26.13
900	18.15. 0	22.10. 0	26. 5. 0	30. 0
1000	20.16. 8	25. 0. 0	29. 3. 4	33. 6
2000	41.13. 4	50. 0. 0	58. 6. 8	66.13
5000	104. 3. 4	125. 0. 0	145.16. 8	166.13
10000	208. 6. 8	250. 0. 0	291.13. 4	333. 6

	9 pence	10 pence	11 pence	12 pence
	li. sh. d.	li. sh. d	li. sh. d,	li. sh. d.
1	9	10	11	1. 0
2	1. 6	1. 8	1 10	2. 0
3	2. 3	2. 6	2. 9	3. 0
4	3. 0	3. 4	3. 8	4. 0
5	3 9	4. 2	4. 7	5. 0
6	4. 6	5. 0	5. 6	6. 0
7	5. 3	5 10	6. 5	7. 0
8	6. 0	6. 8	7. 4	8. 0
9	6. 9	7. 6	8 3	9. 0
10	7. 6	8. 4	9. 2	10. 0
20	15.0	16. 8	18. 4	1. 0. 0
30	1. 2. 6	1. 5. 0	1. 7. 6	1.10. 0
40	1.10. 0	1.13. 4	1.16. 8	2. 0. 0
50	1.17. 6	2. 1. 8	2. 5.10	2.10. 0
60	2 5. 0	2 10. 0	2.15. 0	3. 0. 0
70	2.12. 6	2.18. 4	3. 4. 2	3.10. 0
80	3. 0. 0	3. 6. 8	3.13. 4	4. 0. 0
90	3. 7. 6	3 15. 0	4. 2. 6	4.10. 0
00	3.15. 0	4. 3. 4	4.11. 8	5. 0. 0
00	7.10. 0	8. 6. 8	9. 3. 4	10. 0. 0
00	11. 5 0	12.10. 0	13. 5. 0	15. 0. 0
00	15. 0. 0	16.13. 4	18. 6. 8	20. 0. 0
00	18.15. 0	20.16. 8	22.18. 4	25. 0. 0
00	22.10. 0	25. 0. 0	27.10. 0	30. 0. 0
00	26. 5. 0	29. 3 4	32. 1. 8	35. 0. 0
00	30. 0. 0	33. 6. 8	36.13. 4	40. 0. 0
00	33.15. 0	37.10. 0	41. 5. 0	45. 0. 0
00	37.10. 0	41.13. 4	45.16. 8	50. 0. 0
00	75. 0. 0	83. 6. 8	91.13. 4	100. 0. 0
00	187.10. 0	208. 6. 8	229. 3. 4	250 0. 0
00	375. 0. 0	416.13. 4	458. 6. 8	500. 0. 0

Forreign Weights and Measures, carefully compared with the Engliſh.

	Engliſh Foot, into 1000 equal parts.	*Engliſh Foot, into inc. and tenth parts of an inch.*	*The pound Averdupois into 100 parts.*
London Foot - -	1000	0.12.0	100
France.			
Paris, the Royal Foot	1.068	1.00.8	0.9
Lyon Ell - -	3.976	3.11.7	1.0
Boloyn Ell - -	2. 76	2.00.8	0.8
The 17 Provinces.			
Amſterdam Foot - - -	.942	0.11.3	0.9
Ell	2.269	2.03.2	
Antwerp Foot - -	.946	0.11.3	0.9
Ell	2.273	2.03.3	
Brill Foot	1.103	1.01.2	
Dort Foot	1.184	1.02.2	
Rynland or *Leyden* Foot	1.033	1.00.4	0.9
Ell -	2.260	2.03.1	
Lorain Foot -	.958	.11.4	0.9
Mechelin Foot -	.919	.11.0	0.9
Middleburg Foot	.991	.11.9	0.9

	Thous. parts	F. I. p	Aver. 100 p.
Germany.			
rasbourgh Foot - -	.920	0.11.0	0.93
emen Foot -	.964	0.11.6	0.94
logn Foot -	.954	0.11.4	0.97
ankford ad Me- *n* Foot -	.948	.11.4	0 93
Ell -	1.826	1. 9.9	
mbrough Ell -	1.995	1.10.8	0.95
ipſig Ell -	2.260	2. 3.1	1.17
bick Ell -	1.903	1. 9,8	
remburg -	1.006	1.00.1	0.94
Ell -	2.227	2. 3.3	
varia -	.954	0.11.4	
enna -	1.053	1.00.6	0.83
ain and *Portu.*			
aniſh Palm, or the Palm of *Caſtile.*	.751	0.09.0	0.99
e *Spaniſh* Vare or Rod, four Palms)	3.004	3.00.0	
eir Foot is $\frac{1}{3}$ of ne Vare -	1.001	1.00.0	
bon Vare -	2.750	2.09.0	1.06
ralter Vare -	2.760	2.09.1	1.03
edo Foot -	.899	0.10.7	1.00
Vare - -	2,685	2.98.2	
Italy.			
nan Foot, on the Monum of *Coſſutius*	.967	0.11.6	1.23
Of *Statilius* -	.972	0.11.7	
an Palm, for build-, whereof ten ake the *Cauna* - -	.732	0.08.8	

	Thouſ. parts.	F. In. p.	Ave 100
Bononia Foot -	1.204	1.02.4	1.27
Ell -	2.147	2.01.7	
Perch, whereof 500 to a Mile - -	12.040	12.00.5	
Florence Brace or Ell	1.913	1.11.0	1.23
Naples Palm -	.861	0.09.6	1.43
Brace-	2.100	2.01.2	
Canna -	6.880	6.10.5	
Genua Palm -	.830	.09.6	1.43
Mantova Foot -	1.569	1.05.8	1.43
Milan Calamus -	6.544	6.06.5	1.40
Parma Cubit -	1.866	1.10.4	1.43
Venice Foot -	1.162	1.01.9	1.53
Other Places.			
Dantzick Foot -	.944	0.11.3	1.19
Ell	1.903	1.10.8	
Copenhagen Foot -	.965	.11.6	0.94
Prague (in *Bohemia*) Foot -	1.026	1.00 3	1.96
Riga Foot -	1.831	1.09.9	
China Cubit -	1 016	1.00.2	
Turin Foot - -	1.062	1.00.7	
Cairo Cubit -	1.824	1.09.9	1.81
Perſian Araſh -	3.197	3.02.3	
Turkiſh Pike, at *Conſtantin.* the greater	2.200	2.02.4	0.86
The *Greek* Foot -	1.007	1.00.1	
The Univerſal meaſure.	3.267	3. 3.2	

A *Pendulum* of the juſt length whereof will vi
brate 60 times in a Minute.

To Guage a Cask which is not full.

A Table for guaging of Wine Casks, which are not full.

G.	parts	G.	parts	G.	parts	G.	parts	G.	parts
0	000	13	2630	26	4330	39	5913	52	7672
½	295		2703		4400		5976		7758
2	470	14	2775	27	4462	40	6040	53	7829
1	602		2847		4542		6094		7909
2	720	15	2918	28	4585	41	6158	54	7990
	830		2986		4646		6223		8072
3	935	16	3056	29	4706	42	6288	55	8154
	1038		3123		4766		6353		8236
4	1138	17	3189	30	4826	43	6418	56	8319
	1235		3255		4835		6483		8404
5	1329	18	3321	31	4943	44	6548	57	8491
	1420		3387		5000		6613		8580
6	1502	19	3452	32	5057	45	6679	58	8661
	1596		3517		5115		6745		8765
7	1681	20	3582	33	5174	46	6811	59	8862
	1764		3647		5234		6877		8962
8	1846	21	3712	34	5294	47	6944	60	9065
	1928		3777		5354		7012		9170
9	2010	22	3842	35	5415	48	7082	61	9280
	2091		3906		5476		7153		9398
10	2171	23	3960	36	5535	49	7225	62	9530
	2242		4024		5600		7297		9705
11	2328	24	4087	37	5662	50	7370	63	10000
	2405		4150		5724		7444		
12	2481	25	4213	38	5787	51	7519		
	2556		4270		5850		7595		

A Table of Meridional Parts.

Deg. L.	0	10	20	30	40	50	D
0	0	16	38	50	66	88	6,5
1	100	116	133	150	166	183	16,5
2	200	216	233	250	267	283	16,5
3	300	317	333	350	367	383	17
4	400	417	433	450	467	484	17
5	500	517	534	551	567	554	17
6	601	618	634	651	668	685	17
7	701	718	735	752	769	785	17
8	802	819	836	853	870	887	17
9	903	920	937	954	971	988	17
10	1005	1022	1039	1056	1082	1090	17
11	1107	1124	1141	1158	1175	1192	17
12	1209	1226	1243	1260	1277	294	17
13	1311	1328	1345	1367	1380	1397	17
14	1414	1431	1448	1465	1483	1500	17
15	1517	1534	1552	1569	1586	1604	17
16	1621	1638	1656	1673	1690	1708	17,5
17	1725	1743	1760	1778	1795	1813	17,5
18	1830	1848	1865	1883	1900	1918	17,5
19	1936	1953	1971	1988	2006	2024	17,5
20	2042	2059	2077	2098	2113	2131	17,5
21	2148	2166	2184	2202	2220	2238	18
22	2256	2274	2292	2310	2328	2346	18
23	2364	2382	2400	2419	2437	2455	18
24	2473	2491	2510	2528	2545	2565	18
25	2583	2601	2620	2638	2657	2675	18
26	2694	2712	2731	2750	2768	2787	18
27	2806	2824	2843	2862	2880	2899	18
28	2918	2937	2956	2975	2994	3013	19
29	3032	3051	3070	3089	3109	3128	19

A Table of Meridional Parts.

Deg. Lat.	0	10	20	30	40	50	D
30	3147	3166	3185	3205	3224	3244	19
31	3263	3282	3302	3322	3341	3361	19
32	3380	3400	3420	3439	3459	3469	20
33	3499	3519	3539	3559	3579	3599	20
34	3619	3639	3659	3679	3700	3720	20
35	3740	3760	3781	3801	3822	3842	20
36	3863	3884	3904	3925	3946	3967	21
37	3987	4008	4029	4050	4071	4092	21
38	4114	4135	4156	4177	4198	4220	21
39	4241	4263	4284	4306	4327	4349	22
40	4371	4393	4414	4436	4458	4480	22
41	4502	4524	4546	4569	4591	4613	22
42	4636	4658	4681	4703	4726	4749	22
43	4771	4794	4817	4840	4863	4886	23
44	4909	4932	4956	4979	5002	5026	23
45	5050	5073	5097	5120	5144	5168	23
46	5192	5216	5240	5265	5289	5313	24
47	5337	5362	5386	5411	5436	5461	25
48	5485	5510	5535	5560	5586	5611	25
49	5636	5662	5687	5713	5739	5764	26
50	5790	5816	5842	5868	5895	5921	26
51	5948	5974	6001	6027	6054	6081	26
52	6108	6135	6162	6190	6217	6245	27
53	6272	6300	6328	6356	6384	6412	28
54	6440	6469	6497	6526	6555	6584	29
55	6613	6642	6671	6700	6730	6760	29
56	6790	6820	6850	6879	6910	6940	30
57	6970	7002	7031	7060	7094	7125	31
58	7156	7188	7220	7252	7284	7316	32
59	7348	7380	7413	7446	7479	7512	33

Deg. Lat.	0	10	20	30	40	50	D
	A Table of Meridional Parts.						
60	7545	7579	7612	7646	7650	7714	34
61	7748	7793	7817	7852	7887	7923	35
62	7958	7994	8029	8065	8102	8138	36
63	8175	8211	8248	8286	8323	8361	37
64	8399	8437	8475	8514	8553	8592	38
65	8631	8671	8710	8750	8791	8831	39
66	8872	8913	8960	8996	9038	9080	41
67	9123	9166	9224	9252	9296	9340	43
68	9384	9429	9474	9517	9565	9611	45
69	9657	9704	9751	9798	9846	9899	47
70	9943	9992	10041	10091	10141	10192	49
71	10242	10294	10346	10398	10450	10504	52
72	10558	10612	10666	10722	10777	10834	54
73	10890	10948	11005	11064	11123	11182	57
74	11242	11303	11365	11427	11989	11553	61
75	11617	11684	11747	11814	11881	11948	67
76	12016	12086	12156	12227	12299	12371	70
77	12445	12519	12595	12672	12749	12828	74
78	12907	12988	13070	13153	13237	13322	81
79	13409	13497	13586	13677	13765	13863	88
80	13958	14055	14153	14253	14355	14459	97
81	14565	14672	14782	14893	15007	15123	107
82	15242	15363	15487	15613	15742	15874	121
83	16009	16148	16289	16435	16584	16737	139
84	16894	17056	17222	17394	17570	17752	162
85	17940	18133	18336	18548	18761	18986	
86	19220	19464	19719	19986	20266	20560	
87	20870	21197	21545	21915	22310	22985	
88	23193	23692	24238	24842	25517	26282	
89	27165	28210	29488	31137	33460	37431	
90	*Infin.*						

Here followeth

A Traverſe TABLE

To Find the

Difference of Longitude and Diſtance.

Which muſt be placed after the Table of Artificial Sines and Tangents: after the Signature H.

A Traverse Table to be entred with the

Diff of Lat.	¼ Poi.		½ Poi.		¾ Poi.		1 Poi.		1¼ Poi.		1½ Poi.		1¾ Poi.		2 Poi.	
M	M		M	P	M	P	M	P	M	P	M	P	M	P	M	P
1		0		1		1		2		2		3		4		4
2		1		2		3		4		5		6		7		8
3		1		3		4		6		7		9	1	1	1	1
4		2		4		6		8	1	0	1	2	1	4	1	6
5	0	2		5		7	1	0	1	2	1	5	1	8	2	0
6	0	3		6		9	1	2	1	5	1	8	2	2	2	4
7	0	3		7	1	0	1	4	1	7	2	1	2	5	2	9
8	0	4		8	1	2	1	6	2	0	2	4	2	9	3	3
9	0	4		9	1	3	1	8	2	2	2	7	3	2	3	7
10	0	5	1	0	1	5	1	9	2	5	3	0	3	6	4	4
11	0	5	1	1	1	6	2	2	2	8	3	3	3	9	4	5
12	0	6	1	2	1	8	2	3	3	1	3	6	4	3	4	9
13	0	6	1	3	1	9	2	6	3	3	3	9	4	7	5	2
14	0	7	1	4	2	1	2	8	3	5	4	2	5	0	5	7
15	0	7	1	5	2	2	3	0	3	8	4	6	5	4	6	2
16	0	8	1	6	2	4	3	2	4	0	4	9	5	7	6	6
17	0	8	1	7	2	5	3	4	4	3	5	2	6	1	7	2
18	0	9	1	8	2	7	3	6	4	5	5	5	6	4	7	5
19	0	9	1	9	2	8	3	8	4	8	5	8	6	8	7	9
20	1	0	2	0	3	0	4	0	5	0	6	1	7	2	8	3
21	1	0	2	1	3	1	4	2	5	3	6	4	7	5	8	7
22	1	1	2	2	3	3	4	4	5	5	6	7	7	9	9	2
23	1	1	2	3	3	4	4	6	5	8	7	0	8	2	9	6
24	1	2	2	4	3	6	4	8	6	0	7	3	8	6	9	9
25	1	2	2	5	3	7	5	0	6	3	7	6	8	9	10	4
30	1	5	3	0	4	5	8	0	7	5	9	1	10	7	12	4
40	2	0	4	0	5	4	8	0	10	0	12	1	14	3	10	6
50	2	5	5	0	7	4	10	0	17	5	15	2	17	0	20	7

2¼ Poi.		2½ Poi.		2¾ Poi.		3 Poi.		3¼ Poi		3½ Poi.		3¾ Poi.		4 Poi.		Dist. of Lat.
M	P	M	P	M	P	M	P	M	P	M	P	M	P	M	P	M
	5		5		6	0	7		7		8		9	1	0	1
	9	1	1	1	2	1	3	1	5	1	6	1	8	2	0	2
1	4	1	6	1	8	2	0	2	2	2	5	2	7	3	0	3
1	9	2	1	2	4	2	7	3	0	3	3	3	6	4	0	4
2	4	2	7	3	0	3	3	3	7	4	1	4	5	5	0	5
2	8	3	2	3	6	4	0	4	5	4	9	5	4	6	0	6
3	3	3	7	4	2	4	7	5	2	5	7	6	3	7	0	7
3	8	4	3	4	8	5	3	5	9	6	6	7	2	8	0	8
4	2	4	8	5	4	6	0	6	7	7	4	8	2	9	0	9
4	7	5	3	6	0	6	7	7	4	8	2	9	1	10	0	10
5	2	5	9	6	6	7	3	8	2	9	0	10	0	11	0	11
5	7	6	4	7	2	8	0	8	9	9	8	10	9	12	0	12
6	1	6	9	7	8	8	7	9	6	10	7	11	8	13	0	13
6	6	7	5	8	4	9	3	10	4	11	5	12	7	14	0	14
7	1	8	0	9	0	10	0	11	1	12	3	13	6	15	0	15
7	6	8	6	9	6	10	7	11	9	13	1	14	5	16	0	16
8	0	9	1	10	2	11	3	12	6	14	0	15	4	17	0	17
8	5	9	6	10	8	12	0	13	4	14	8	16	3	18	0	18
9	0	10	2	11	4	12	7	14	1	15	6	17	2	19	0	19
9	5	10	7	12	0	13	4	14	8	16	4	18	1	20	0	20
9	9	11	2	12	6	14	0	15	6	17	2	19	0	21	0	21
10	4	11	8	13	2	14	7	16	3	18	1	19	9	22	0	22
10	9	12	3	13	8	15	3	17	1	18	9	20	8	23	0	23
11	3	12	8	14	4	16	0	17	8	19	7	21	5	24	0	24
11	8	13	4	15	0	16	7	18	5	20	5	22	7	25	0	25
14	2	16	0	18	0	20	0	22	3	24	6	27	2	30	0	30
18	9	21	4	24	0	26	7	29	7	32	8	36	3	40	0	40
23	7	26	7	29	0	33	4	31	1	41	0	45	3	50	0	50

A Traverse Table to be entred with the

Dif. of Lat.	4¼ Poi.		4½ Poi.		4¾ Poi.		5 Poi.		5¼ Poi.		5½ Poi.		5¾ Poi.		6 Poi.	
M	M	P.	M	P.	M	P	M	P	M	P	M	P	M	P	M	P
1	1	1	1	2	1	3	1	5	1	7	1	9	2	1	2	4
2	2	2	2	4	2	7	3	0	3	3	3	7	4	2	4	8
3	3	3	3	7	4	0	4	5	5	0	5	6	6	3	7	2
4	4	4	5	1	5	4	6	0	6	7	7	5	8	4	9	6
5	5	6	1	6	7	7	5	8	3	9	4	10	6	12	0	
6	6	7	3	8	1	9	0	10	0	11	2	12	7	14	4	
7	7	8	5	9	4	10	5	11	7	13	1	14	8	16	9	
8	8	9	7	10	8	12	0	13	3	15	0	16	9	19	2	
9	9	11	0	12	1	13	5	15	0	16	8	19	0	21	8	
10	11	0	12	2	13	5	15	0	16	7	18	7	21	1	24	2
11	12	1	13	4	14	8	16	5	18	4	20	6	23	3	26	6
12	13	2	14	6	16	2	18	0	20	0	22	4	25	4	29	0
13	14	3	15	8	17	5	19	5	21	7	24	3	27	5	31	4
14	15	4	17	1	18	9	21	0	23	4	26	2	29	6	33	8
15	16	5	18	3	20	2	22	5	25	0	28	1	31	7	36	2
16	17	6	19	5	21	6	24	0	26	7	29	9	33	8	38	6
17	18	9	20	7	22	9	25	4	28	4	31	8	35	9	41	0
18	19	9	21	9	24	3	26	9	30	0	33	7	38	1	43	5
19	21	0	23	1	25	6	28	4	31	7	35	5	40	2	45	9
20	22	1	24	4	27	0	29	9	33	4	37	4	42	3	48	3
21	23	2	25	6	28	3	31	4	35	0	39	3	44	4	50	7
22	24	3	26	8	29	7	32	9	36	7	41	1	46	5	53	1
23	25	4	28	0	31	0	34	4	38	4	43	0	48	6	55	5
24	26	5	29	2	32	4	35	9	40	0	44	9	50	7	57	9
25	27	6	30	5	33	7	37	4	41	7	46	8	52	9	60	4
30	33	1	36	5	40	5	44	9	50	0	56	1	63	4	72	4
40	44	1	48	7	53	9	59	9	66	7	74	8	84	6	96	6
50	55	2	60	9	67	4	74	8	83	4	93	5	105	7	120	7

6¼ Poi.		6½ Poi.		6¾ Poi.		7 Poi.		7¼ Poi.		7½ Poi.		7¾ Poi.		Diff. of Lat.
M	P	M	P	M	P	M	P	M	P	M	P	M	P	M
2	8	3	3	4	0	5	0	6	7	10	2	20	4	1
5	6	6	6	8	0	10	0	13	5	20	3	40	7	2
8	4	9	9	12	0	15	1	20	2	30	5	61	1	3
11	2	13	2	16	0	20	1	27	0	40	6	81	4	4
14	0	16	5	20	0	25	1	33	7	50	8	101	8	5
16	8	19	8	24	0	30	2	40	5	60	9	122	4	6
19	6	23	1	28	9	35	2	47	2	71	1	142	5	7
22	4	26	4	31	9	40	2	53	9	81	2	162	8	8
25	2	29	7	35	9	45	2	60	7	91	4	183	2	9
27	9	33	0	39	9	50	3	67	4	101	5	203	6	10
30	7	36	2	43	9	55	3	74	2	111	7	223	9	11
33	5	39	6	47	9	60	3	80	9	121	8	244	3	12
36	3	42	9	51	9	65	4	87	6	132	0	264	6	13
39	1	46	2	55	9	70	4	94	4	142	1	285	0	14
41	9	49	4	59	9	75	4	101	1	152	3	305	3	15
44	7	52	7	63	9	80	4	107	9	162	4	325	7	16
47	5	56	0	67	9	85	5	114	6	172	6	346	0	17
50	3	59	3	71	9	90	5	121	3	182	7	366	4	18
53	1	62	5	75	8	95	5	128	1	192	9	386	7	19
55	9	65	9	79	8	100	5	134	8	203	1	07	1	20
58	7	69	2	83	8	105	6	141	6	213	2	427	5	21
61	5	72	5	87	8	110	6	148	3	223	4	447	8	22
64	3	75	8	91	8	115	6	155	0	233	5	468	2	23
67	1	79	1	95	8	120	6	161	8	243	7	488	5	24
69	9	82	4	99	0	125	7	168	5	253	8	508	9	25
83	8	98	9	119	8	150	8	202	2	304	6	610	7	30
111	8	131	9	159	7	201	1	269	7	406	1	814	2	40
139	9	164	8	199	6	251	4	337	1	507	7	1017	8	50

A Traverse Table to find the

Lat.	1 Rumb. 11 15		2 Rumb. 22 30		3 Rumb. 33 45		4 Rumb. 45 00		5 Rumb. 56 15	
D. M.	Long	dif.	Long.	dif.	Long.	dif.	Long	dif.	Long.	dif.
0 10	2	10	4	11	7	1	10	14	15	18
20	4	20	8	22	13	25	20	28	30	36
30	6	31	12	32	20	36	30	42	45	54
40	8	41	16	43	27	48	40	57	1 0	72
50	10	51	20	54	33	60	50	71	1 15	90
1 0	12	61	24	65	40	72	1 0	85	1 30	108
10	14	71	29	76	47	84	1 10	99	1 45	126
20	16	82	33	87	53	96	1 20	113	2 00	144
30	18	92	37	97	1 0	100	1 30	127	2 15	162
40	20	102	41	108	1 7	110	1 40	141	2 30	180
50	22	112	45	119	1 13	122	1 50	156	2 45	198
2 0	24	122	49	130	1 20	144	2 0	171	3 00	216
10	26	133	53	141	1 27	156	2 10	184	3 15	234
20	28	143	57	152	1 33	168	2 20	198	3 30	252
30	30	153	1 2	162	1 40	180	2 30	212	3 45	270
40	32	163	1 6	173	1 47	192	2 40	226	4 0	288
50	34	173	1 10	184	1 53	204	2 50	240	4 15	309
3 0	36	184	1 15	194	2 0	216	3 0	255	4 30	324
10	38	194	1 19	206	2 7	229	3 10	269	4 45	342
20	40	204	1 23	216	2 13	241	3 20	283	5 0	360
30	42	214	1 27	227	2 20	252	3 30	297	5 15	378
40	44	224	1 32	238	2 27	265	3 40	311	5 30	396
50	46	234	1 36	249	2 33	277	3 50	325	5 45	424
4 0	48	245	1 39	260	2 40	289	4 0	339	6 0	432
10	50	255	1 44	271	2 57	301	4 10	344	6 15	451
20	52	265	1 48	281	2 54	312	4 20	358	6 30	468
30	54	275	1 52	292	3 1	325	4 30	372	6 45	481
40	56	285	1 56	303	3 7	337	4 40	386	7 0	504
50	58	295	2 00	314	3 14	346	4 50	390	7 15	527

Difference of Longitude, and Distance.

Lat.	1 Rumb. 11 15		2 Rumb. 22 30		3 Rumb. 33 45		4 Rumb. 45 00		5 Rumb. 56 15	
D. M.	Long.	dif.	Long.	dif.	Long.	dif.	Long.	dif.	Long.	dif.
5 0	1 0	306	2 4	325	3 20	361	5 0	424	7 30	540
20	1 2	316	2 8	336	3 27	373	5 10	438	7 45	558
10	1 4	326	2 13	346	3 34	385	5 20	453	8 0	576
30	1 6	336	2 16	357	3 40	397	5 30	467	8 15	594
40	1 8	347	2 20	368	3 47	409	5 40	481	8 30	612
50	1 10	357	2 24	378	3 54	421	5 50	495	8 45	630
6 0	1 12	367	2 28	390	4 1	433	6 0	509	9 0	640
10	1 14	377	2 33	401	4 7	445	6 10	523	9 15	666
20	1 16	387	2 37	411	4 14	457	6 20	537	9 30	684
30	1 18	398	2 41	422	4 21	469	6 30	552	9 45	702
40	1 20	408	2 45	433	4 27	481	6 40	536	10 0	720
50	1 22	418	2 50	443	4 34	493	6 50	580	10 15	738
7 0	1 24	428	2 54	566	4 41	505	7 0	594	10 30	756
10	1 26	438	2 58	475	4 47	517	7 10	608	10 45	775
20	1 28	449	3 2	576	4 54	529	7 20	622	11 0	792
30	1 30	459	3 6	487	5 1	541	7 30	636	11 16	810
40	1 32	469	3 11	498	5 8	553	7 40	651	11 32	828
50	1 34	479	3 15	509	5 14	565	7 50	665	11 46	846
8 0	1 36	480	3 19	520	5 21	577	8 0	679	12 1	864
10	1 38	500	3 24	530	5 28	589	8 10	693	12 16	882
20	1 40	510	3 28	541	5 35	601	8 20	707	12 31	900
30	1 42	520	3 32	552	5 41	613	8 30	721	12 47	918
40	1 44	530	3 36	563	5 48	625	8 40	735	13 2	936
50	1 46	540	3 40	574	5 55	637	8 50	749	13 17	95

A Traverse Table to find the

6 Rumb. 67 30			7 Rumb. 78 45			Lat.	1 Rumb. 11 15			2 Rumb. 22 30		
Long.		dif.	Long.		Dif.	D. M.	Long.		dif.	Long.		Dif
	24	26		51	51	9 0	1	48	568	3	44	584
	48	52	1	38	103	10	1	50	561	3	49	595
1	12	78	2	29	154	20	1	52	571	3	53	606
1	36	105	3	20	205	30	1	54	581	3	57	617
2	0	131	4	11	256	40	1	56	591	4	01	628
						50	1	58	602	4	05	638
2	24	157	5	02	308	10 0	2	0	612	4	10	649
2	49	183	5	53	359	10	2	2	622	4	14	660
3	13	209	6	44	410	20	2	4	632	4	18	671
3	38	235	7	35	461	30	2	6	642	4	22	682
4	02	261	8	22	513	40	2	8	653	4	26	693
4	26	287	9	13	564	50	2	10	663	4	30	704
4	50	314	10	4	615	11 0	2	12	673	4	34	714
5	14	340	10	55	666	10	2	14	683	4	38	725
5	38	366	11	42	718	20	2	16	693	4	42	732
6	02	392	12	33	769	30	2	18	704	4	46	747
6	20	418	13	24	820	40	2	20	714	4	54	758
6	50	444	14	16	871	50	2	22	724	4	56	768
7	14	470	15	7	923	12 0	2	24	734	5	2	779
7	38	496	15	54	974	10	2	26	744	5	5	790
8	02	523	16	49	1025	20	2	28	755	5	9	801
8	26	559	17	36	1076	30	2	30	765	5	13	812
8	52	575	18	27	1128	40	2	32	775	5	17	823
9	15	601	19	18	1179	50	2	34	785	5	21	833
0	39	627	20	9	1230	13 0	2	36	795	5	26	844
0	04	653	21	0	1281	10	2	38	805	5	30	855
0	29	679	21	48	1333	20	2	40	816	5	34	866
10	53	706	22	39	1384	30	2	43	826	5	38	877
11	17	732	23	30	1435	40	2	45	836	5	43	887
11	45	758	24	21	1487	50	2	47	846	5	47	898

Difference of Longitude and Distance.

6 Rumb. 67 30		7 Rumb. 8 45	
Long.	dist.	Long.	dist.
12 05	1814	25 8	1538
12 29	8101	26 3	1589
12 53	8362	26 51	1640
13 17	8621	27 42	1641
13 42	8588	28 33	1743
14 06	9155	29 25	1794
14 30	9411	30 14	1845
14 55	9693	31 3	1897
15 19	9933	31 54	1948
15 44	10193	32 46	1999
16 8	10455	33 27	2050
16 33	10711	34 20	2102
16 57	10981	35 18	153
17 21	11241	36 7	2204
17 45	11501	37 0	255
18 10	11761	38 0	2307
18 34	12021	38 42	2368
18 58	12281	39 29	2409
19 22	12541	0 21	2460
19 47	12801	0 12	2512
20 11	13071	42 4	2563
20 35	13331	42 51	2614
21 00	13591	43 43	2665
21 24	1381	44 34	2717

Lat.	1 Rumb. 11 15		2 Rumb. 22 30	
D. M.	Long.	dist.	Long.	dist.
14	2 49	8565	51	929
10	2 51	8675	55	920
20	2 53	8778	00	931
30	2 55	8875	4	942
40	2 57	8976	8	952
50	2 59	9076	13	963
15 0	3 1	9186	17	974
10	3 3	9286	21	985
20	3 6	9386	26	996
30	3 8	9486	30	1007
40	3 10	9586	34	1017
50	3 12	9696	39	1028
16 0	3 14	9796	43	1039
10	3 16	9896	47	1050
20	3 18	9996	51	1061
30	3 20	10096	55	1072
40	3 22	10196	59	1082
50	3 24	10297	04	1093
17 0	3 26	10407	9	1104
10	3 28	10507	1	1115
20	3 30	10607	17	1126
30	3 32	10707	21	1136
40	3 34	10817	26	1147
50	3 36	10917	30	1158

A Traverse Table to find the

Lat.	3 Rumb. 33 45			4 Rumb. 45 00			5 Rumb. 56 14			6 Rumb. 67 30			7 Rumb. 78 4		
D. M.	Long.	dist.		Long.	dist.		Long.	dist		Long.	dist.		Long.	dist.	
9 0	6 2	649		9 1	764		13 32	972		21 50	1411		45 2	27	
10	6 8	661		9 12	778		13 47	990		22 14	1437		46 18	281	
20	6 15	673		9 22	792		14 2	1008		22 39	1463		47 9	287	
30	6 22	686		9 33	806		14 16	1026		23 03	1489		47 5	292	
40	6 29	698		9 42	820		14 32	1044		23 27	1516		48 4	297	
50	6 35	709		9 52	834		14 48	1062		23 52	1542		49 41	302	
10 0	6 42	722		10 3	849		15 3	1080		24 16	1568		50 32	307	
10	6 49	734		10 13	863		15 17	1098		24 41	1544		51 24	312	
20	6 56	746		10 23	877		15 33	1116		25 05	1620		52 16	317	
30	7 1	758		10 33	891		15 47	1134		25 30	1646		52 04	322	
40	7 9	770		10 44	905		16 3	1152		25 54	1662		53 56	327	
50	7 16	782		10 54	919		16 18	1170		26 18	1689		54 48	332	
11 0	7 23	794		11 4	933		16 34	1188		26 43	1725		55 36	337	
10	7 30	806		11 14	948		16 49	1206		27 8	1751		56 28	342	
20	7 36	818		11 24	956		17 5	1224		27 32	1777		57 20	347	
30	7 44	830		11 34	966		17 19	1242		27 58	1803		58 12	352	
40	7 51	842		11 44	980		17 35	1260		28 22	1829		59 41	357	
50	7 58	854		11 55	994		17 50	1278		28 47	1855		59 56	363	
12 0	8 4	866		12 5	1018		18 5	1296		29 12	1881		60 48	369	
10	8 11	878		12 15	1032		18 20	1314		29 36	1908		61 36	374	
20	8 18	890		12 26	1047		18 37	1332		30 00	1934		62 28	379	
30	8 25	902		12 35	1061		18 51	1350		30 25	1960		63 20	384	
40	8 32	914		12 46	1075		19 7	1368		30 50	1986		64 12	389	
50	8 39	926		12 56	1089		19 22	1386		31 15	2012		65 05	394	
13 0	8 46	938		13 6	1103		19 38	1404		31 39	2038		65 55	399	
10	8 52	950		13 17	1117		19 52	1422		32 04	2064		66 46	404	
20	8 59	962		13 28	1131		20 8	1440		32 29	209		67 38	410	
30	9 6	974		13 38	1146		20 34	1458		32 53	2117		68 30	415	
40	9 14	986		13 48	1160		20 39	1476		33 18	2143		69 23	420	
50	9 21	998		13 58	1174		20 54	1494		33 43	2169		70 15	425	

r.	3 Rumb. 35 00		4 Rumb. 45 00		5 Rumb. 56 15		6 Rumb. 67 3		7 Rumb. 78 4	
.M	Long.	dist.	Long	list.	Long	dist.	Long	dist	Long	dist.
0	9 28	1016	14 8	1188	21 10	1512	34 10	2195	71 0	4306
10	9 34	1022	14 18	1202	21 25	1530	34 34	222	71 57	4357
20	9 41	1034	14 29	1216	21 40	1548	34 59	2247	72 49	4408
30	9 47	1046	14 30	1230	21 55	1566	35 24	227	73 42	4459
40	9 54	1058	14 49	1244	22 11	1584	35 49	2300	74 34	4511
50	10 01	1070	14 59	1259	22 26	1592	36 13	2326	75 23	4562
0	10 8	1082	15 10	1272	22 43	1620	36 38	2357	76 16	61;
10	10 15	1094	15 21	1281	22 57	1638	37 03	2378	77 9	4664
20	10 22	1106	15 31	1301	23 14	1656	37 28	2404	78 2	4715
30	10 30	1118	15 41	1315	23 28	1674	37 52	2430	78 55	7867
40	10 37	1131	15 51	1329	23 44	1692	38 18	2450	79 47	818
50	10 44	1143	16 1	1343	24 04	1710	38 42	208	80 38	870
0	10 50	1155	16 12	1358	24 16	1728	39 8	2509	81 29	402
10	10 56	1167	16 23	1372	24 31	1746	39 35	2535	82 28	497
20	11 3	1179	16 33	1386	24 47	1766	39 58	2561	83 16	502
30	11 10	1191	16 44	1400	25 2	1782	40 25	2587	84 09	507
40	11 17	1203	16 55	1414	25 18	1800	40 50	2613	84 58	512
50	11 24	1215	17 5	1428	25 34	1818	41 15	26:9	85 55	5177
0	11 31	1227	17 15	1442	25 49	1836	41 40	2665	86 44	52:8
10	11 39	1239	17 25	1457	26 0	1864	42 5	2691	87 48	5280
20	11 46	1251	17 36	1471	26 21	1872	42 30	2718	88 31	5331
30	11 53	1263	17 47	1485	26 36	1890	42 56	2744	89 28	5383
40	12 00	1275	17 57	1499	26 52	1908	43 21	2770	90 18	5433
50	12 07	1287	18 8	1513	27 8	1926	43 46	2796	91 7	5488

A Traverse Table to find the

Lat.	1 Rumb.		2 Rumb.		3 Rumb.		4 Rumb.	
	11 15		22 30		33 45		45 00	
D. M.	Long.	dist.	Long.	dist.	Long.	dist.	Long	dist.
18 0	3 38	1101	7 34	1167	12 14	1290	18 19	1527
10	3 40	1111	7 40	1180	12 21	1313	18 29	1541
20	3 42	1122	7 44	1191	12 28	1323	18 39	1556
30	3 44	1132	7 48	1201	12 35	1335	18 49	1570
40	3 46	1142	7 52	1212	12 42	1347	19 0	1584
50	3 49	1152	7 57	1223	12 49	1359	19 10	1598
19 0	3 51	1162	8 1	1234	12 56	1371	19 21	1612
10	3 53	1173	8 5	1245	13 03	1383	19 31	1626
20	3 55	1183	8 10	1256	13 11	1395	19 42	1640
30	3 57	1193	8 14	1266	13 18	1407	19 53	1655
40	3 59	1203	8 19	1277	13 25	1419	20 4	1669
50	4 01	1214	8 22	1288	13 32	1431	20 14	1683
20 0	4 4	1224	8 28	1298	13 39	1443	20 25	1697
10	4 7	1234	8 32	1310	13 46	1455	20 35	1711
20	4 9	1244	8 36	1321	13 53	1467	20 46	1725
30	4 11	1254	8 41	1331	14 2	1479	20 57	1739
40	4 13	1264	8 45	1342	14 8	1491	21 7	1744
50	4 15	1274	8 49	1352	14 15	1503	21 18	1758
21 0	4 17	1285	8 54	1364	14 22	1515	21 28	1782
10	4 19	1293	8 59	1375	14 29	1527	21 39	1796
20	4 21	1303	9 3	1385	14 36	1539	21 50	1811
30	4 23	1315	9 7	1396	14 44	1551	22 1	1825
40	4 25	1325	9 12	1407	14 51	1563	22 12	1839
50	4 27	1336	9 16	1418	14 58	1575	22 22	8 54
22 0	4 29	1346	9 20	1429	15 5	1588	22 33	1867
10	4 31	1356	9 25	1440	15 12	1600	22 44	1871
20	4 33	1366	9 30	1450	15 19	1612	22 55	885
30	4 35	1376	9 34	1461	15 26	1624	23 6	1899
40	4 37	1387	9 38	1472	15 33	1636	23 17	19 3
50	4 40	1397	9 43	1483	15 41	1648	23 28	1917

Difference of Longitude and Distance.

Lat.	1 Rumb. 11 15		2 Rumb. 22 30		3 Rumb. 33 45		5 Rumb. 45 00	
D.M	Long.	dist.	Long.	dist.	Long.	dist.	Long.	dist.
23 0	4 42	1407	9 48	1494	15 48	1660	23 39	1952
10	4 44	1417	9 52	1525	15 55	1672	23 45	1966
20	4 46	1427	9 57	1515	16 3	1684	24 00	1980
30	4 48	1438	10 2	1526	16 10	1696	24 11	1993
40	4 50	1448	10 7	1537	16 17	1708	24 22	2008
50	4 52	1458	10 11	1548	16 24	1728	24 23	2022
24 0	4 55	1468	10 15	1559	16 31	1732	24 44	2036
10	4 57	1478	10 19	1570	16 39	1744	24 55	2041
20	4 59	1489	10 24	1580	16 46	1756	25 6	2055
30	5 2	1499	10 29	1591	16 53	1768	25 17	2069
40	5 4	1509	10 33	1602	17 1	1780	25 28	2083
50	5 6	1519	10 37	1613	17 8	1792	25 32	2097
25 0	5 8	1530	10 42	1624	17 16	1804	25 50	2121
10	5 10	1540	10 46	1634	17 23	1816	26 1	2135
20	5 12	1550	10 51	1645	17 30	1828	26 12	2150
30	5 14	1560	10 56	1656	17 38	1840	26 23	2164
40	5 16	1570	11 1	1667	17 45	1852	26 34	2178
50	5 18	1580	11 5	1678	17 52	1864	26 45	2192
26 0	5 21	1591	11 9	1688	18 0	1876	26 56	2206
10	5 23	1601	11 14	1699	18 7	1888	27 7	2220
20	5 26	1611	11 19	1710	18 15	1800	27 18	2234
30	5 28	1621	11 23	1721	18 22	1912	27 29	249
40	5 30	1631	11 28	1732	18 30	1924	27 40	2263
50	5 32	1642	11 32	2743	18 37	1930	27 51	2275

A Traverse Table to find the

Lat.	5 Rumb. 56 15			6 Rumb. 67 30			7 Rumb. 78 45		
D. M.	Long.		dist.	Long.		dist.	Long		dist.
18 0	27	24	1944	44	11	2822	92	01	5536
10	27	39	1962	44	37	2848	92	55	5587
20	27	55	1980	44	2	2874	93	44	5638
30	28	11	1998	45	27	2621	94	40	5690
40	28	27	2016	35	55	2927	95	32	5741
50	28	42	2034	46	18	2953	95	56	5791
19 0	28	58	2052	46	45	2979	97	29	5843
10	29	14	2070	47	11	3005	98	14	5895
20	29	29	2088	47	36	3031	99	04	5946
30	29	46	2106	48	2	3057	99	58	5997
40	30	32	2124	48	27	3083	100	52	6048
50	30	18	2142	48	53	3110	101	46	6100
20 0	30	34	2160	49	18	3136	102	40	6151
10	30	50	2178	49	44	3162	103	30	6202
20	31	6	2186	50	09	3185	104	25	6254
30	31	21	2214	50	35	216	105	19	6305
40	31	37	2232	51	01	3230	106	14	6356
50	31	53	2250	51	26	3266	107	08	6407
21 0	32	9	2268	51	52	3292	108	3	6458
10	32	25	2286	52	20	3319	108	53	6510
20	32	42	2034	52	43	3345	109	48	6561
30	32	57	2322	53	11	3371	110	43	6612
40	33	14	2340	53	37	3397	111	38	6664
50	33	30	2358	54	03	4423	112	32	6715
22 0	33	46	2376	54	29	3449	113	25	6746
10	34	2	2394	54	55	3475	114	20	6797
20	34	18	2412	55	21	3502	115	13	6849
30	34	35	2430	55	47	3528	116	09	6920
40	34	51	2448	56	12	3554	117	44	6951
50	35	07	2466	56	39	3580	117	59	7003

Lat.	1 Rumb		
D. M.	Long.		dist
27 0	5	34	165
10	5	36	166
20	5	39	167
30	5	41	168
40	5	43	169
50	5	46	170
28 0	5	48	171
10	5	50	172
20	5	52	173
30	5	55	174
40	5	57	175
50	6	00	176
29 0	6	02	177
10	6	04	178
20	6	07	179
30	6	09	180
40	6	11	181
50	6	13	182
30 0	6	16	183
10	6	18	184
20	6	20	185
30	6	23	186
40	6	25	187
50	6	27	187
31 0	6	29	189
10	6	31	190
20	6	34	191
30	6	36	192
40	6	39	193
50	6	41	194

Difference of Longitude, and Distance.

t.	5 Rumb. 56 15		6 Rumb. 67 30		7 Rumb. 78 45		Lat.	1 Rumb.	
M.	Long.	dist.	Long.	dist.	Long.	dist.	D. M	Long.	dist.
0	35 23	2484	57 05	3606	118 56	7075	32 0	6 43	1958
10	35 40	2502	57 31	3632	119 45	7126	10	6 46	1988
20	35 56	2520	57 57	3658	120 41	7177	20	6 48	1978
30	36 12	2538	58 23	3684	121 37	7228	30	6 50	1988
40	36 28	2556	58 52	3712	122 32	7280	40	6 52	1998
50	36 45	2574	59 18	3736	123 24	7331	50	6 55	2009
0	37 1	2592	59 44	3763	124 24	7381	33 0	6 57	2019
10	37 17	2610	60 11	3789	125 15	7432	10	7 00	2029
20	37 34	2628	60 37	3815	126 11	7484	20	7 03	2039
30	37 50	2646	61 03	3841	127 7	7535	30	7 05	2049
40	38 7	2664	61 30	3867	128 0	7586	40	7 08	2060
50	38 22	2682	61 56	3894	128 57	7537	50	7 10	2070
0	38 40	2700	62 22	3920	129 52	7689	34 0	7 13	2080
10	38 56	2718	62 49	3946	130 48	7740	10	7 15	2090
20	39 13	2736	63 15	3972	131 44	7791	20	7 18	2008
30	39 29	2754	63 42	3998	132 56	7842	30	7 20	2111
40	39 46	2772	64 09	4024	133 33	7894	40	7 22	2121
50	40 2	2790	64 34	4050	134 29	7945	50	7 24	2131
0	40 19	2808	65 02	4076	135 26	7996	15 0	7 25	2141
10	40 36	2826	65 31	4103	136 23	8048	10	7 29	2151
20	40 53	2844	65 56	4129	137 20	8098	20	7 31	2162
30	41 09	2862	66 26	4155	138 17	8150	30	7 34	2172
40	41 26	2880	66 30	4181	139 9	8201	40	7 36	2182
50	41 42	2898	67 19	4207	140 7	8253	50	7 3	2192

A Traverse Table to find the

2 Rumb.		3 Rumb.		4 Rumb.		5 Rumb.	
Long.	dist.	Long.	dist.	Long	dist.	Long.	dist.
11 37	1753	18 45	1948	28 03	2291	42 00	2916
11 42	1764	18 42	1960	28 14	2305	42 17	2934
11 47	1775	19 03	1972	28 27	2319	42 33	2952
11 51	1780	29 07	1984	28 35	2323	42 50	2970
11 56	1797	19 15	1996	28 49	2348	43 07	2983
12 01	1808	19 22	2008	28 59	2362	43 24	3006
12 06	1818	19 30	2021	29 11	2376	43 41	3024
12 10	1829	19 37	2033	29 22	2390	43 58	3042
12 15	1840	19 45	2045	29 34	2404	44 15	3060
12 20	1851	19 56	2057	29 46	2418	44 32	3078
12 25	1862	20 00	2069	29 57	2432	44 49	3096
12 30	1872	20 08	2081	30 08	2447	45 06	3114
12 34	1883	20 16	2093	30 19	2461	45 23	3132
12 39	1894	20 23	2105	30 31	2475	45 40	3150
12 42	1905	20 30	2117	30 43	2489	45 57	3168
12 48	1916	20 38	2129	30 54	2503	46 15	3186
12 52	1927	20 46	2141	31 05	2517	46 22	3204
12 57	1937	20 54	2153	31 17	2531	46 49	3222
13 02	1948	21 01	2165	31 28	2546	47 06	3240
13 07	1959	21 09	2177	31 40	2560	47 24	3258
13 11	1970	21 17	2189	31 51	2574	47 41	3276
13 16	1981	21 24	2201	32 03	2588	47 58	3294
13 22	1992	21 32	2213	32 15	2602	48 16	3312
13 26	2002	21 40	2225	32 29	2616	48 33	3330
13 30	2013	21 47	2237	32 38	2630	48 50	3348
13 35	2024	21 55	2249	32 49	2645	49 08	3366
13 40	2035	22 03	2261	33 00	2659	49 25	3384
13 45	2046	22 11	2273	33 12	2673	49 53	3402
13 50	2056	22 19	2285	33 25	2687	50 01	3420
13 56	2067	22 27	2297	33 37	2701	50 18	3438

Difference of Longitude, and Distance.

2 Rumb.		3 Rumb.		4 Rumb.		5 Rumb.	
Long	dist.	Long	dist.	Long	dist.	Long.	dist.
14 01	2708	22 34	2309	33 48	2715	50 36	3456
14 06	2089	22 42	2321	34 00	2730	50 53	3474
14 10	2100	22 50	2333	34 12	2744	51 11	3492
14 1	2111	22 58	2345	34 24	2758	51 29	3510
14 20	2121	23 06	2357	34 36	2772	51 47	3528
14 25	2132	23 14	2369	34 48	2786	52 04	3546
14 30	2143	23 21	2381	35 00	2800	52 22	3564
14 35	2154	23 30	2393	35 12	2814	52 10	3532
14 40	2165	23 38	2405	35 23	2828	52 58	3600
14 45	2176	23 46	2417	35 35	2843	53 16	3618
14 49	2186	23 54	2429	35 47	2857	53 34	3636
14 54	2197	24 02	2441	35 59	2871	53 50	3654
14 59	2208	24 10	2454	36 11	2885	54 10	3672
15 04	2219	24 18	2466	36 23	2891	54 28	3690
15 09	2230	24 26	2478	36 36	2903	54 46	3708
15 14	2240	24 34	2490	36 47	2917	55 04	3726
15 20	2251	24 42	2502	36 56	2932	55 22	3744
15 25	2262	24 50	2514	37 12	2946	55 41	3762
15 29	2273	24 59	2526	37 24	2970	55 59	3780
15 34	2284	25 07	2538	37 36	2984	56 17	3798
15 39	2295	25 15	2550	37 48	2998	56 35	3816
15 44	2305	25 23	2562	38 30	3012	56 54	3834
15 50	2316	25 31	2574	38 13	3026	57 12	3852
15 55	2327	25 40	2586	38 25	3041	57 30	3870

A Traverse Table to find the

Lat.	6 Rumb.		7 Rumb.	
D. M.	Long.	dist.	Long.	dist.
27 0	67 45	4233	141 04	8304
10	68 12	4259	142 01	8355
20	68 39	4285	142 56	8406
30	69 06	4312	143 51	8458
40	69 33	4338	144 49	8500
50	70 00	4344	145 46	8560
28 0	70 27	4390	146 44	8611
10	70 55	4416	147 33	8663
20	71 22	4442	148 35	8714
30	71 49	4468	149 33	8765
40	72 19	4495	150 31	8816
50	72 44	4521	131 29	8868
29 0	73 14	4547	152 28	8919
10	73 41	4573	153 24	8970
20	74 09	4599	154 23	9021
30	74 37	4623	155 19	9073
40	75 04	4651	156 17	9124
50	75 32	4677	157 16	9175
30 0	76 00	4704	158 15	9226
10	76 27	4730	159 14	9278
20	76 55	4756	160 08	9329
30	77 23	4782	161 08	9380
40	77 51	4808	162 07	9431
50	78 19	4834	163 06	9483
31 0	78 87	4860	164 03	9534
10	79 17	4886	165 03	9585
20	79 43	4913	166 01	9636
30	80 13	4939	167 00	9688
40	80 41	4965	168 00	9739
50	81 10	4991	169 00	9790

Lat.	1 Rumb.		2 Rumb.	
D. M.	Long.	dist.	Long.	dist.
36 0	7 41	2202	16 00	233
10	7 43	2212	16 05	234
20	7 46	2223	16 11	236
30	7 48	2233	16 16	237
40	7 50	2243	16 21	238
50	7 53	2253	16 26	239
37 0	7 56	2263	16 32	240
10	7 59	2274	16 37	241
20	8 02	2284	16 42	242
30	8 04	2294	16 47	243
40	8 06	2304	16 52	244
50	8 09	2314	16 57	245
38 0	8 11	2325	17 02	246
10	8 13	2335	17 08	247
20	8 16	2345	17 13	249
30	8 19	2355	17 18	250
40	8 21	2366	17 23	251
50	8 24	2376	17 28	251
39 0	8 26	2386	17 32	253
10	8 28	2396	17 39	254
20	8 31	2406	17 44	255
30	8 34	2417	17 49	256
40	8 37	2427	17 55	257
50	8 39	2437	18 00	258
40 0	8 42	2447	18 06	259
10	8 44	2457	18 12	260
20	8 47	2467	18 20	261
30	8 49	2478	18 22	262
40	8 52	2488	18 28	263
50	8 55	2498	18 24	264

Difference of Longitude and Distance.

	6 Rumb.		7 Rumb.	
	Long.	dist.	Long.	dist.
0	81 38	5017	170 00	9842
10	82 06	5043	170 55	9893
20	82 35	5069	171 55	9944
30	83 05	5095	172 56	9995
40	83 34	5122	173 56	10047
50	84 01	5148	174 53	10098
0	84 29	5174	175 54	10149
10	84 58	5200	176 55	10200
20	85 26	5226	177 56	10252
30	85 55	5252	178 57	10303
40	86 26	5278	179 53	10354
50	86 52	5305	180 57	10405
0	87 24	5331	181 56	10457
10	87 52	5357	182 57	10508
20	88 02	5383	183 59	10559
30	88 50	5409	184 59	10610
40	89 20	5435	185 58	10662
50	89 49	5461	187 00	10713
0	90 19	5488	188 02	10764
10	90 47	5514	189 05	10815
20	91 18	5540	190 04	10867
30	91 48	5566	191 06	10918
40	92 17	5592	192 09	10969
50	92 46	5618	193 11	11020

Lat.	1 Rumb.		2 Rumb.	
D. M.	Long.	dist.	Long.	dist.
41 0	8 57	2500	18 40	2663
10	9 00	2519	18 45	2674
20	6 03	2529	18 50	2684
30	9 06	2539	18 56	2695
40	9 08	2549	19 01	2706
50	9 12	2560	19 06	2717
42 0	9 13	2569	19 12	2728
10	9 16	2580	19 18	2730
20	9 18	2590	19 23	2749
30	9 21	2600	19 29	2760
40	9 24	2610	19 35	2771
50	9 27	2620	19 40	2882
43 0	9 30	2631	19 46	2793
10	9 32	2641	19 51	2803
20	9 35	2651	19 57	2814
30	9 37	2661	20 03	2825
40	9 40	2671	20 06	2836
50	9 48	2682	20 13	2847
44 0	9 46	2692	20 19	2858
10	9 48	270	20 26	2869
20	9 51	2712	20 32	2879
30	9 54	2723	20 38	2890
40	9 57	2733	0 94	2001
50	10 00	2743	20 50	2912

A Traverse Table to find the

3 Rumb.			4 Rumb.			5 Rumb.			6 Rumb.		
Long		dist.	Long.		dist.	Long.		dist.	Long.		dist.
25	49	2598	38	38	3055	57	49	3888	93	10	5614
25	57	2610	38	50	3069	58	08	3906	93	48	5670
26	05	2622	39	03	3083	58	26	3924	94	10	5697
26	1	2634	39	15	3097	58	45	3942	94	48	5723
26	22	2646	39	27	3111	59	03	3960	95	18	5741
26	30	2658	39	40	3125	59	22	3978	95	48	5775
26	38	2670	39	53	3140	59	41	3996	96	18	5801
26	47	2681	40	05	3154	60	00	4014	96	48	5827
26	55	2693	40	18	3168	60	18	4032	97	18	5853
27	03	2705	40	31	3182	60	37	4050	97	48	5879
27	12	2717	40	43	3196	60	56	4068	98	19	5906
27	20	2729	40	56	3210	61	15	4086	98	49	5932
27	28	2742	41	08	3224	61	34	4104	99	19	5958
27	37	2754	41	21	3239	61	52	4122	99	49	5984
27	45	2766	41	33	3253	62	12	4140	100	20	6010
27	54	2778	41	46	3262	62	31	4158	100	51	6036
28	03	2790	42	00	3281	62	50	4176	101	21	6062
28	11	2802	42	13	3296	63	09	4194	101	52	6089
28	20	2814	42	26	3309	63	29	4212	102	26	6115
28	29	2826	42	39	3323	63	48	4230	102	56	6141
28	37	2838	42	52	3338	64	07	4248	103	28	6167
28	46	2850	43	04	3352	64	27	4266	103	58	6193
28	55	2862	43	17	3366	64	46	4284	104	30	6219
29	04	2874	43	30	3380	65	06	4302	105	02	6245
29	12	2886	43	43	3394	65	25	4320	105	32	6271
29	21	2898	43	56	3408	65	45	4338	106	04	6298
29	30	2911	44	09	3422	66	04	4356	106	35	6324
29	38	2923	44	21	3437	66	24	4374	107	06	6350
29	47	2935	44	34	3451	66	44	4392	107	37	6378
29	56	2947	44	48	3465	67	04	4410	108	10	6402

Difference of Longitude, and Distance.

3 Rumb.		4 Rumb.		5 Rumb.		6 Rumb.	
Long.	Dist.	Long.	dist.	Long.	dist.	Long.	dist.
30 05	2959	45 02	3479	67 23	4428	108 42	6428
30 14	2971	45 16	3493	67 43	4436	109 16	6454
30 23	2983	45 29	3507	68 03	4454	109 46	6480
30 32	2995	45 42	3521	68 23	4472	110 20	6507
30 40	3006	45 55	3535	68 43	4490	110 52	6533
30 50	3019	46 08	3550	69 03	4508	111 25	6559
31 00	3031	46 22	3564	69 23	4526	111 56	6585
31 08	3043	46 36	3574	69 43	4554	112 29	6611
31 17	3055	46 49	3592	70 04	4572	113 01	6637
31 26	3067	47 02	3606	70 24	4590	113 34	6667
31 35	3079	47 16	3620	70 44	4608	114 06	6690
31 44	3091	47 30	3634	71 04	4626	114 39	6716
31 53	3103	47 43	3649	71 25	4644	115 12	6742
32 20	3115	47 56	3663	71 45	4662	115 45	6768
32 11	3127	48 10	3677	72 06	4680	116 19	6794
32 20	3139	48 25	3691	72 27	4698	116 51	6820
32 29	3151	48 39	3715	72 47	4716	117 27	6846
32 38	3163	48 53	3729	73 08	4734	117 58	6872
32 47	3175	49 06	3733	73 29	4752	118 34	6899
32 57	3187	49 20	3748	73 50	4770	119 06	6925
33 07	3199	49 34	3762	74 11	4788	119 40	6951
33 16	3211	49 48	3776	74 31	4806	120 13	6977
33 25	3223	50 02	3790	74 52	4824	120 48	7003
33 34	3235	50 16	3804	75 12	4842	121 21	7029

A Traverse Table to find the

7 Rumb.	
Long.	Dist.
194 14	11072
195 17	11123
196 18	1174
197 20	11226
198 22	11277
199 26	11328
200 24	11379
201 31	11421
202 33	11472
203 37	11423
204 41	11574
205 46	11626
206 50	11687
207 54	11738
208 55	11789
210 06	11841
211 05	11892
212 10	11943
213 15	11994
214 20	12046
215 24	12097
216 29	12148
217 35	82199
218 41	12231
219 42	12302
220 49	12353
221 56	12404
223 03	12456
224 18	12057
225 11	12558

Lat.	1 Rumb.		2 Rumb.		3 Rum	
D. M.	Long.	dist.	Long.	dist.	Long.	d
45 0	10 03	2733	20 36	2923	33 48	3
10	10 06	2762	21 01	2933	33 53	3
20	10 08	2773	21 07	2944	34 02	3
30	10 11	2783	21 16	2955	34 12	4
40	10 14	2794	21 19	2966	34 23	3
50	10 18	2804	21 24	2977	34 53	3
46 0	10 19	2814	21 31	2988	34 42	3
10	10 22	2824	21 37	2998	34 52	3
20	10 25	2835	21 42	3009	35 01	3
30	10 28	2845	21 48	3029	35 11	3
40	10 31	2855	91 54	3031	35 21	3
50	10 34	2865	22 00	2041	35 30	33
47 0	10 37	2875	22 06	3052	35 40	3
10	10 40	2886	22 12	3063	35 50	34
20	10 43	2896	22 18	3074	36 00	34
50	10 45	2906	22 24	3085	36 10	34
40	10 48	2916	22 30	3096	56 20	34
50	10 51	2926	22 36	3106	36 30	24
48 0	10 54	2936	22 41	3117	36 40	34
10	10 57	2947	22 49	3128	36 50	34
20	11 00	2957	22 56	3139	37 00	54
30	11 04	2967	23 03	3150	37 10	35
40	11 07	2977	23 10	3161	37 20	35
50	11 10	2987	23 16	3171	37 30	35
49 0	11 13	2998	23 22	3182	37 40	35
10	11 16	3008	23 27	3193	37 50	35
20	11 19	3018	23 33	3204	38 00	35
30	11 22	3028	23 40	3215	38 10	3
40	11 25	3038	23 46	3125	38 20	3
50	11 28	3049	23 52	3236	38 00	3

Difference of Longitude and Distance.

Rumb.	
ng.	Dist.
23	12609
27	12661
35	12712
43	12763
46	12815
58	12866
03	12917
12	12968
21	13020
30	13061
34	13112
43	13163
53	13215
82	13266
12	13317
20	13368
34	13420
39	13471
50	13532
01	13583
12	13635
23	13686
29	13737
41	13788

Lat.	1 Rumb.		2 Rumb.		3 Rumb.	
D. M.	Long.	dist.	Long.	dist.	ong.	dist.
50 0	11 31	3059	23 59	3247	38 42	3608
10	11 34	3069	24 05	3258	38 52	3620
20	11 37	3079	24 12	3269	39 03	3632
30	11 40	3089	24 19	3280	39 13	3644
40	11 44	3100	24 26	3290	39 24	3656
50	11 47	3110	24 32	3301	39 34	3668
51 0	11 50	3120	24 38	3312	39 45	3680
10	11 53	3130	24 45	3323	39 55	3692
20	11 56	3140	24 52	3334	40 06	3704
30	12 00	3150	24 58	3345	40 16	3716
40	12 03	3161	25 05	3355	40 27	3728
50	12 06	3171	25 12	3366	40 38	3741
52 0	12 09	3181	25 18	3377	40 49	3753
10	12 12	3191	25 25	3388	41 00	3765
20	12 15	3202	25 32	3399	41 10	3777
30	12 19	3212	25 39	3410	41 22	3789
40	12 22	3222	25 45	3420	41 32	3801
50	12 26	3232	25 52	3431	41 43	3813
53 0	12 29	3242	25 56	3442	41 55	3825
10	12 32	3253	26 09	3453	42 06	3837
20	12 36	5263	26 13	4564	42 17	3849
30	12 39	3273	26 20	3474	42 28	3861
40	12 47	3283	26 27	3485	42 40	3873
50	12 45	3293	26 34	3495	42 51	2885
54 0	12 49	3303	26 41	3507	43 03	3897
10	12 52	3314	26 48	3518	43 14	3909
20	12 56	3324	26 58	3529	43 25	3921
30	12 59	3334	26 02	3539	43 37	2933
40	12 02	3344	27 09	3550	43 48	2945
50	12 05	3355	27 16	3561	44 00	3957

A Traverse Table to find the

4 Rumb.		5 Rumb.		6 Rumb.		7 Rumb.	
Long.	dist.	Long.	dist.	Long.	dist.	Long.	dist.
50 30	3818	75 35	4860	121 56	7055	253 34	13840
50 43	3832	75 56	5878	122 30	7082	255 04	13801
50 57	3847	76 17	4896	123 04	7108	256 11	13942
51 12	3861	76 38	4914	123 38	7134	257 24	13993
51 26	3875	77 00	4932	124 13	7160	258 38	14045
51 40	3889	77 21	4950	124 47	7186	259 50	14096
51 54	3903	77 43	4968	125 22	7212	261 04	14147
52 10	3917	78 04	4986	125 56	7238	262 12	14198
52 25	3931	78 26	5004	126 31	7264	263 28	14250
52 39	3946	78 47	5022	127 08	7291	264 39	14301
52 54	3960	79 09	5040	127 43	7317	265 53	14352
53 18	3974	72 30	5058	128 18	7343	267 08	14403
53 23	3988	79 53	5076	128 53	7369	268 23	14455
53 37	4002	80 15	5094	129 28	7395	269 23	14506
53 52	4016	80 37	5112	130 04	7321	270 47	14557
54 06	4030	80 59	5130	130 40	7347	272 02	14609
54 21	4045	81 22	5148	131 13	7373	273 18	14660
54 36	4059	81 43	5166	131 52	7400	274 34	14711
54 52	4073	82 06	5184	132 28	7426	275 50	14762
55 05	4 87	82 28	5202	133 03	7452	277 00	14814
55 22	4101	82 51	5220	133 38	7478	278 17	14865
55 37	5115	83 14	5238	134 16	7504	279 34	14916
55 51	4129	83 36	5256	134 54	7530	280 51	14967
56 07	144	83 58	5274	135 28	7556	282 08	15019
56 22	4158	84 22	5292	136 07	7683	283 23	15070
56 38	4172	84 44	5310	136 42	7709	284 38	15121
56 52	4186	85 07	5328	137 20	7735	285 56	15172
57 08	4200	85 30	5346	137 57	7761	287 24	15224
57 23	4214	85 54	5364	138 34	7787	288 33	15275
57 39	4228	86 16	5382	139 12	7813	289 46	15326

A Traverse Table to find the

4 Rumb.		5 Rumb.		6 Rumb.		7 Rumb.	
ng.	dist.	Long.	dist.	Long.	dist.	Long.	dist.
54	4243	86 44	5400	139 49	7839	291 05	15377
10	4255	87 03	5418	140 26	7865	292 24	15429
26	4271	87 27	5426	141 04	7892	295 44	15410
42	4285	87 50	5454	141 41	7918	296 01	15531
58	4299	88 14	5472	142 20	7944	296 24	15582
14	4313	88 39	5480	142 58	7970	297 45	15634
30	4327	89 01	5508	143 36	7996	299 00	15685
46	4342	89 25	5526	144 17	8022	300 21	15730
02	4356	89 49	5544	144 52	8048	301 43	15477
17	4370	90 13	5562	145 33	8074	303 04	15839
33	4384	90 37	5580	146 12	8101	304 20	15890
49	4398	91 00	5598	146 51	8121	305 42	15634
05	4412	91 25	5616	147 30	8153	307 05	15992
21	4426	91 50	5634	148 09	8179	308 28	160 4
37	4441	92 14	5652	148 48	8205	309 52	16045
54	4455	92 39	5670	149 28	8231	311 12	16146
10	4369	93 03	5688	150 07	8257	312 36	16198
26	4483	93 28	5606	150 47	8284	213 57	16249
43	4497	93 53	5724	151 27	8310	315 22	16300
00	4511	94 18	5742	152 07	8336	316 46	16351
17	4525	94 43	5760	152 47	8362	318 12	16403
34	4540	95 03	5778	153 27	8388	319 35	16454
51	4554	95 33	5796	154 11	8414	320 56	16505
08	4568	95 58	5714	154 48	8440	322 23	16556
24	4582	96 24	5832	155 32	8467	323 49	16608
41	4596	96 58	5850	156 13	8493	325 16	16699
58	4610	97 15	5868	156 54	8519	326 40	16710
15	4624	97 40	5886	157 36	8545	328 04	16761
32	4638	98 07	5904	158 37	8571	329 33	16813
50	4653	98 37	5922	158 58	8557	329 01	16864

A Traverse Table to find the

Lat.	1 Rumb.		2 Rumb.		3 Rumb.		4 Rumb.	
D. M.	Long.	dist.	Long.	dist.	Long.	dist.	Long.	dist.
55 0	13 07	3365	27 21	3570	44 9	3959	66 06	4667
10	13 10	3375	27 27	3582	44 21	3981	66 24	4681
20	13 16	3385	27 36	3593	44 33	3993	65 42	4695
30	13 19	3395	27 45	3604	44 45	4005	67 00	4709
40	13 23	3405	27 54	3614	44 57	4017	67 18	4723
50	13 26	3415	27 57	3626	45 09	4030	67 36	4737
56 0	13 30	3426	28 06	3636	45 22	4041	67 54	4751
10	13 33	3436	28 15	3648	45 34	4052	68 12	4765
20	13 36	3446	28 21	3658	45 46	4063	68 30	4779
30	13 39	3456	28 27	3669	45 56	4077	68 45	4793
40	13 42	3466	28 33	3680	46 12	4089	69 06	4807
50	13 48	3476	28 42	3691	46 24	4101	69 24	4821
57 0	13 51	3487	28 48	3697	46 34	4113	69 42	4836
10	13 54	3497	28 57	3712	49 46	4125	70 00	4850
20	13 57	3507	29 03	3725	47 57	4137	70 18	4864
30	14 00	3517	29 12	3734	47 20	4149	70 36	4878
40	14 06	3527	29 18	3745	47 32	4161	70 54	4892
50	14 09	3537	29 24	3755	47 44	4173	71 15	4906
58 0	14 12	3548	29 36	3766	47 49	4185	71 33	4921
10	14 15	3558	29 45	3777	48 00	4197	71 51	4935
20	14 18	3568	29 54	3787	48 12	4209	72 12	4949
30	14 21	3578	30 00	3779	48 26	4221	72 30	4963
40	14 24	3588	30 09	3810	48 40	4233	72 48	4977
50	14 27	3598	30 18	3821	48 51	4245	73 09	4991
59 0	14 36	3609	30 24	3831	49 05	4257	73 37	5007
10	14 39	3619	30 30	3842	49 17	4269	73 48	5021
20	14 42	3629	30 36	3853	49 29	4281	74 06	5035
30	14 48	3639	30 48	3863	49 35	4293	74 27	5049
40	14 51	3649	30 54	3875	49 46	4305	74 45	5063
50	14 54	3659	31 06	3886	49 58	4317	75 06	5077

Difference of Longitude and Distance.

Lat.	1 Rumb.		2 Rumb.		3 Rumb.		4 Rumb.	
D.M.	Long.	dist.	Long.	dist.	Long.	dist.	Long.	dist.
60 0	15 00	3670	31 15	3897	50 25	4330	75 27	5091
10	15 03	3680	31 21	3907	50 36	4342	75 45	5105
20	15 06	3690	31 27	3918	50 48	4354	76 06	5119
30	15 12	3700	31 37	3929	51 05	4367	76 27	4133
40	15 15	3710	31 49	3940	51 07	4379	76 48	5147
50	15 18	3720	31 54	3950	51 31	4390	77 06	5161
61 0	15 21	3742	32 09	3961	51 45	4402	77 27	5176
10	15 24	3742	32 15	3972	52 03	4414	77 34	5190
20	15 27	3752	32 21	3983	52 13	4426	78 09	5204
30	15 36	3762	32 30	3994	52 27	4438	78 30	5218
40	15 36	3772	32 36	4005	52 39	4450	78 51	5232
50	15 45	3782	32 45	4016	52 56	4462	79 12	5246
62 0	15 48	3793	32 57	4027	53 09	4474	79 33	5261
10	15 51	3803	33 03	4038	53 21	4486	79 57	5275
20	15 54	3813	33 12	4049	53 39	4498	80 15	5289
30	16 00	3823	33 18	4060	53 54	4510	80 39	5303
40	16 03	3833	33 33	4071	54 07	4522	81 00	5317
50	16 06	3843	33 49	4082	54 20	4535	81 21	5331
63 0	16 15	3854	33 51	4093	54 37	4546	81 45	5346
10	16 18	3864	34 00	4104	54 50	4558	82 06	5360
20	16 21	3874	34 09	4115	55 05	4570	82 27	5374
30	16 27	3884	34 18	4126	55 22	4582	82 51	3388
40	16 30	3894	34 27	4137	55 39	4594	83 12	5392
50	16 33	3904	34 36	4148	55 55	4606	83 36	4406
64	16 39	3914	34 45	4157	56 56	4618	83 57	5421

A Traverse Table to find the

5 Rumb.		6 Rumb.		7 Rumb.	
Long.	dist.	Long.	dist.	Long.	dist.
98 55	5940	159 25	8623	332 18	16911
99 13	5957	160 18	8649	333 48	16962
99 49	5975	161 02	8676	335 18	17025
100 16	5992	161 45	8702	336 48	17067
100 43	6010	162 30	8728	338 06	17115
101 10	6027	163 14	8754	339 36	17202
101 37	6048	163 55	8781	341 27	17223
102 04	6065	164 40	8808	342 57	17268
102 31	6082	165 18	8832	343 27	27328
102 54	6100	165 58	8856	345 36	17376
103 25	6120	166 39	8885	346 06	17421
103 52	6138	167 50	8911	357 26	17469
104 18	6156	168 18	8937	350 44	17529
104 45	6173	168 59	8963	351 54	17577
105 13	6191	169 62	8989	353 24	17640
105 40	6209	170 27	9015	354 54	17685
106 06	6228	171 09	9042	356 24	17730
106 33	6245	171 58	9066	357 57	17793
107 50	6264	172 45	9094	359 52	17878
107 46	6282	173 35	9120	361 22	17886
108 03	6299	174 20	9144	362 52	17946
108 30	6318	175 03	9177	394 27	17988
108 57	6336	175 45	9199	365 57	18039
109 27	6253	176 20	9224	367 27	18099
109 55	6371	177 18	9251	369 15	18147
110 23	6389	178 09	9276	370 45	18193
110 50	6409	178 59	9303	372 25	18255
111 27	6426	179 58	9330	374 24	18300
111 54	6441	180 35	9355	375 54	18348
112 23	6462	181 18	9381	377 34	18408

5 Rumb.		6 Rumb.		7 Rumb.	
Long.	dist.	Long.	dist.	Long.	dist.
112 50	6479	182 50	9407	379 18	18444
113 27	6497	182 52	9434	380 48	18501
113 59	6516	183 40	9460	222	18561
114 30	6534	184 30	9486	384 21	18606
114 57	6552	185 19	9512	385 57	18659
115 29	6570	185 18	9537	387 31	18714
115 55	6588	187 00	9564	389 21	18762
116 24	6606	187 48	9590	390 51	18807
116 58	6623	188 42	9617	392 21	18870
117 29	6642	189 30	9642	394 39	18915
117 99	6660	190 12	9669	396 24	18960
118 32	6678	291 00	9695	398 09	19023
119 03	6696	192 03	9721	399 57	19368
119 34	6714	192 51	9747	401 42	19116
120 05	6731	193 48	9773	403 36	19176
120 42	6749	194 42	9800	405 30	19221
121 20	6766	195 30	9826	407 15	19269
121 52	6786	196 18	9832	409 00	19332
122 21	6804	197 21	9878	411 00	19377
122 51	6822	198 48	9904	412 50	19422
123 32	6840	199 37	9930	514 02	19485
124 09	6857	200 24	9956	416 30	19530
124 29	6875	201 10	9982	418 24	19575
124 59	6894	201 58	10008	420 18	19638
125 38	6912	202 42	10034	422 03	19686

A Table to reduce Miles of Eafting,

Parall.	1 Mile.			2 Miles.			3 Miles.			4 Miles.			5 Miles.		
	d.	m.	f.	d.	m.	f.	d.	m.	f.	d.	m.	f.	d.	m.	f.
0	0	1	0	0	2	0	0	3	0	0	4	0	0	5	0
1	0	1	0	0	2	0	0	3	0	0	4	0	0	5	0
2	0	1	0	0	2	0	0	3	0	0	4	0	0	5	0
3	0	1	0	0	2	0	0	3	0	0	4	0	0	5	0
4	0	1	0	0	2	0	0	3	0	0	4	1	0	5	1
5	0	1	0	0	2	0	0	3	1	0	4	1	0	5	1
6	0	1	0	0	2	1	0	3	1	0	4	1	0	5	2
7	0	1	0	0	2	1	0	3	1	0	4	2	0	5	2
8	0	1	1	0	2	1	0	3	2	0	4	2	0	5	3
9	0	1	1	0	2	1	0	3	2	0	4	3	0	5	5
10	0	1	1	0	2	2	0	3	3	0	4	4	0	5	5
11	0	1	1	0	2	2	0	3	3	0	4	4	0	5	6
12	0	1	2	0	2	3	0	3	4	0	4	5	0	5	7
13	0	1	2	0	2	3	0	3	5	0	4	6	0	5	8
14	0	1	2	0	2	4	0	3	5	0	4	7	0	5	9
15	0	1	2	0	2	4	0	3	6	0	4	8	0	5	11
16	0	1	2	0	2	5	0	3	7	0	4	10	0	5	12
17	0	1	3	0	2	6	0	3	8	0	4	11	0	5	14
18	0	1	3	0	2	6	0	3	9	0	4	12	0	5	15
19	0	1	3	0	2	7	0	3	10	0	4	14	0	5	17

Westing into Degrees of Longitude.

0	0 1 4	0 2 8	0 3 12	0 4 15	0 5 18
1	0 1 4	0 2 9	0 3 13	0 4 17	0 5 21
22	0 1 5	0 2 9	0 3 14	0 4 19	0 5 24
23	0 1 5	0 2 10	0 3 16	0 4 21	0 5 26
24	0 1 6	0 2 11	0 3 17	0 4 23	0 5 28
25	0 1 6	0 2 12	0 3 19	0 4 25	0 5 31
26	0 1 7	0 2 13	0 3 20	0 4 27	0 5 34
27	0 1 7	0 2 15	0 3 22	0 4 29	0 5 37
28	0 1 8	0 2 16	0 3 24	0 4 31	0 5 39
29	0 1 9	0 2 17	0 3 26	0 4 34	0 5 43
30	0 1 9	0 2 19	0 3 28	0 4 37	0 5 46
31	0 1 10	0 2 20	0 3 30	0 4 40	0 5 50
32	0 1 11	0 2 21	0 3 32	0 4 43	0 5 54
33	0 1 12	0 2 23	0 3 35	0 4 46	0 5 58
34	0 1 12	0 2 25	0 3 37	0 4 50	0 6 02
35	0 1 13	0 2 26	0 3 40	0 4 53	0 6 06
36	0 1 14	0 2 28	0 3 42	0 4 57	0 6 11
37	0 1 15	0 2 30	0 3 45	0 5 01	0 6 16
38	0 1 16	0 2 32	0 3 48	0 5 05	0 6 21
39	0 1 17	0 2 34	0 3 52	0 5 09	0 6 26
40	0 1 18	0 2 37	0 3 55	0 5 13	0 6 32
41	0 1 19	0 2 39	0 3 58	0 5 18	0 6 37
42	0 1 21	0 2 41	0 4 02	0 5 23	0 6 44
43	0 1 22	0 2 44	0 4 06	0 5 28	0 6 50
44	0 1 23	0 2 47	0 4 10	0 5 24	0 6 59

A Table to reduce Miles of Easting,

Parall.	6 Mile.			7 Mile.			8 Miles.			9 Miles.			10 Mile.			20 Mil		
	d.	m.	f.	d.	m.	f.	d.	m.	f.	d.	m.	f.	d.	m.	f.	d.	m.	f
0	0	6	0	0	7	0	0	8	0	0	9	0	0	10	0	0	20	0
1	0	6	0	0	7	0	0	8	0	0	9	0	0	10	0	0	20	0
2	0	6	0	0	7	0	0	8	0	0	9	1	0	10	1	0	20	1
3	0	6	0	0	7	1	0	8	1	0	9	1	0	10	1	0	20	2
4	0	6	1	0	7	1	0	8	1	0	9	1	0	10	1	0	20	2
5	0	6	1	0	7	2	0	8	2	0	9	2	0	10	2	0	20	5
6	0	6	2	0	7	2	0	8	3	0	9	3	0	10	3	0	20	6
7	0	6	3	0	7	3	0	8	4	0	9	4	0	10	4	0	20	8
8	0	6	3	0	7	4	0	8	4	0	9	5	0	10	6	0	20	10
9	0	6	4	0	7	5	0	8	6	0	9	6	0	10	7	0	20	10
10	0	6	6	0	7	7	0	8	7	0	9	8	0	10	9	0	20	16
11	0	6	7	0	7	8	0	8	9	0	9	10	0	10	11	0	20	22
12	0	6	8	0	7	9	0	8	11	0	9	12	0	10	13	0	20	27
13	0	6	9	0	7	11	0	8	12	0	9	14	0	10	16	0	20	32
14	0	6	11	0	7	13	0	8	15	0	9	16	0	10	10	0	20	37
15	0	6	13	0	7	15	0	8	17	0	9	19	0	10	21	0	20	42
16	0	6	14	0	7	17	0	8	19	0	9	22	0	10	24	0	00	49
17	0	6	16	0	7	19	0	8	22	0	9	25	0	10	27	0	20	55
18	0	6	18	0	7	21	0	8	25	0	9	28	0	10	31	0	20	02
19	0	6	20	0	7	24	0	8	28	0	9	31	0	10	34	0	20	09

0	0 6 22	0 7 25	0 8 29	0 9 34	0 10 38	0 21 17
1	0 6 26	0 7 30	0 8 34	0 9 38	0 10 43	0 21 25
2	0 6 28	0 7 33	0 8 38	0 9 42	0 10 47	0 21 34
3	0 6 31	0 7 37	0 8 41	0 9 47	0 10 52	0 21 44
4	0 6 33	0 7 39	0 8 44	0 9 50	0 10 57	0 21 54
5	0 6 37	0 7 43	0 8 50	0 9 56	0 11 02	0 22 04
26	0 6 40	0 7 57	0 8 54	0 10 01	0 11 07	0 22 15
27	0 6 42	0 7 51	0 8 59	0 10 06	0 11 13	0 22 27
28	0 6 47	0 7 55	0 9 63	0 10 11	0 11 19	0 22 37
29	0 6 52	0 8 00	0 9 09	0 10 17	0 11 26	0 22 52
30	0 6 56	0 8 05	0 9 14	0 10 24	0 11 33	0 23 06
31	0 7 00	0 8 10	0 9 20	0 10 30	0 11 40	0 23 19
32	0 7 04	0 8 15	0 9 26	0 10 37	0 11 47	0 23 35
33	0 7 09	0 8 21	0 9 32	0 10 44	0 11 55	0 23 51
34	0 7 14	0 8 27	0 9 39	0 10 51	0 12 04	0 24 08
35	0 7 19	0 8 33	0 9 46	0 10 59	0 12 12	0 24 25
36	0 7 25	0 8 39	0 9 53	0 11 58	0 12 22	0 24 45
37	0 7 31	0 8 46	0 10 01	0 11 16	0 12 31	0 25 03
38	0 7 37	0 8 53	0 10 09	0 11 25	0 12 41	0 25 23
39	0 7 43	0 9 00	0 10 18	0 11 35	0 12 52	0 25 40
40	0 7 50	0 9 08	0 10 27	0 11 45	0 13 03	0 26 06
41	0 7 57	0 9 16	0 10 36	0 11 55	0 13 15	0 26 30
42	0 8 04	0 9 25	0 10 46	0 12 07	0 13 27	0 26 54
43	0 8 12	0 9 34	0 11 56	0 12 20	0 13 42	0 27 25
44	0 8 21	0 9 44	0 11 07	0 12 31	0 13 54	0 27 48

A Table to reduce Miles of Eafting, c

Parall.	1 Mile.			2 Miles.			3 Miles.			4 Miles.			5 Miles.		
	d.	m.	f.	d.	m.	f.	d.	m.	f.	d.	m.	f.	d.	m.	f.
45	0	1	25	0	2	50	0	4	15	0	5	39	0	7	4
46	0	1	26	0	2	53	0	4	19	0	5	45	0	7	12
47	0	1	28	0	2	56	0	4	24	0	5	52	0	7	20
48	0	1	30	0	2	59	0	4	29	0	5	59	0	7	28
49	0	1	31	0	3	03	0	4	34	0	6	06	0	7	37
50	0	1	33	0	3	07	0	4	40	0	6	13	0	7	47
51	0	1	35	0	3	11	0	4	46	0	6	21	0	7	57
52	0	1	37	0	3	14	0	4	52	0	6	30	0	8	07
53	0	1	40	0	3	19	0	4	59	0	6	38	0	8	18
54	0	1	42	0	3	24	0	5	66	0	6	48	0	8	30
55	0	1	45	0	3	29	0	5	14	0	6	59	0	8	43
56	0	1	47	0	3	35	0	5	27	0	7	09	0	8	56
57	0	1	50	0	3	40	0	5	39	0	7	21	0	9	11
58	0	1	33	0	3	46	0	5	40	0	7	33	0	9	26
59	0	1	56	0	3	53	0	5	49	0	7	46	0	9	42
60	0	2	00	0	4	00	0	6	00	0	8	09	0	10	00
61	0	2	04	0	4	07	0	6	11	0	8	15	0	10	19
62	0	2	08	0	4	16	0	6	23	0	8	31	0	10	39
63	0	2	12	0	4	24	0	6	36	0	8	49	0	11	01
64	0	2	17	0	4	34	0	6	51	0	9	07	0	11	24

Westing into Degrees of Longitude.

65	0 2 22	0 4 44	0 7 06	0 9 28	0 11 58
66	0 2 28	0 4 45	0 7 23	0 9 50	0 12 16
67	0 2 33	0 5 06	0 7 39	0 10 12	0 12 45
68	0 2 40	0 5 20	0 8 00	0 10 41	0 13 38
69	0 2 47	0 5 34	0 8 21	0 11 80	0 13 55
70	0 2 55	0 5 50	0 8 45	0 11 40	0 14 35
71	0 3 04	0 6 09	0 9 13	0 12 18	0 15 22
72	0 3 14	0 6 28	0 9 42	0 12 56	0 16 11
73	0 3 25	0 6 50	0 10 15	0 13 41	0 17 06
74	0 3 38	0 7 15	0 10 53	0 14 30	0 18 08
75	0 3 52	0 7 44	0 11 36	0 15 28	0 19 20
76	0 4 08	0 8 16	0 12 24	0 16 32	0 20 40
77	0 4 27	0 8 54	0 13 21	0 17 48	0 21 15
78	0 4 48	0 9 37	0 14 25	0 19 14	0 24 02
79	0 5 14	0 10 29	0 15 45	0 20 58	0 26 12
80	0 5 45	0 11 31	0 17 16	0 23 02	0 28 47
81	0 6 23	0 12 47	0 19 10	0 25 34	0 32 57
82	0 7 11	0 14 22	0 21 33	0 28 44	0 35 55
83	0 8 12	0 16 25	0 24 37	0 32 50	0 41 02
84	0 9 34	0 19 08	0 28 42	0 38 16	0 47 50

A Table to reduce Miles of Easting,

Parall.	6 Mile.	7 Miles.	8 Miles.	9 Miles.	10 Mile.	20 M
	d. m. s.	d. m. s.	d. m. s.	d. m. s.	d. m. s.	d. m.
45	0 8 29	0 9 54	0 11 19	0 12 44	0 14 08	0 28 1
46	0 8 38	0 10 05	0 11 31	0 12 57	0 14 24	0 28 4
47	0 8 48	0 10 16	0 11 44	0 13 13	0 14 40	0 29 2
48	0 8 58	0 10 28	0 11 57	0 13 27	0 14 57	0 29 5
49	0 9 08	0 10 40	0 12 12	0 13 43	0 15 14	0 30 2
50	0 9 20	0 10 53	0 12 27	0 14 00	0 15 33	0 31 0
51	0 9 22	0 11 06	0 12 33	0 14 08	0 15 53	0 31 4
52	0 9 44	0 11 22	0 13 00	0 14 37	0 16 14	0 32 2
53	0 9 58	0 11 38	0 13 18	0 14 57	0 16 37	0 33 1
54	0 10 12	0 11 55	0 13 36	0 15 19	0 17 01	0 34 0
55	0 10 28	0 12 12	0 13 57	0 15 41	0 17 26	0 34 52
56	0 10 44	0 12 31	0 14 18	0 16 05	0 17 52	0 35 46
57	0 11 01	0 12 51	0 14 41	0 16 31	0 18 21	0 36 43
58	0 11 19	0 13 13	0 15 06	0 16 59	0 18 52	0 37 44
59	0 11 39	0 13 35	0 15 32	0 17 28	0 19 24	0 38 50
60	0 12 00	0 14 00	0 16 00	0 18 00	0 20 00	0 40 00
61	0 12 22	0 14 26	0 16 30	0 18 33	0 20 37	0 41 15
62	0 12 47	0 14 55	0 17 02	0 19 10	0 21 18	0 42 36
63	0 13 13	0 15 25	0 17 37	0 19 49	0 22 12	0 44 03
64	0 13 41	0 15 58	0 18 15	0 20 32	0 22 48	0 45 37

Westing into Degrees of Longitude.

65	0 14 12	0 16 34	0 18 55	0 21 18	0 23 40	0 47 09
66	0 14 45	0 17 12	0 19 40	0 22 08	0 24 35	0 49 10
67	0 15 18	0 17 51	0 20 24	0 22 57	0 25 35	0 51 10
68	0 16 01	0 18 42	0 21 27	0 23 56	0 26 42	0 53 24
69	0 16 42	0 19 29	0 22 16	0 25 03	0 27 54	0 55 45
70	0 17 30	0 20 25	0 23 20	0 26 13	0 29 14	0 59 28
71	0 18 36	0 21 31	0 24 36	0 27 39	0 30 44	1 01 28
72	0 19 25	0 22 39	0 25 52	0 29 06	0 32 22	1 04 44
73	0 20 31	0 23 56	0 27 22	0 30 47	0 34 12	1 08 24
74	0 21 46	0 25 23	0 29 00	0 32 38	0 36 16	1 12 26
75	0 23 12	0 27 04	0 30 56	0 34 48	0 38 40	1 17 20
76	0 24 48	0 28 56	0 33 04	0 37 12	0 40 20	1 20 40
77	0 26 42	0 31 09	0 35 36	0 39 03	0 42 30	1 25 03
78	0 28 50	0 33 34	0 38 28	0 43 16	0 48 04	1 36 08
79	0 31 26	0 36 41	0 41 56	0 47 10	0 52 24	1 44 48
80	0 34 32	0 40 18	0 46 04	0 51 48	0 57 34	1 55 08
81	0 38 20	0 44 44	0 51 06	0 57 30	1 03 54	2 07 48
82	0 43 06	0 50 17	0 57 28	1 04 39	1 21 50	2 43 40
83	0 49 14	0 57 27	1 05 40	1 13 51	1 22 04	2 44 08
84	0 57 24	1 06 58	1 16 32	1 26 06	1 35 40	3 11 30

A Table to reduce Miles of Eafting, o

Parall.	30 Mil.			40 Mil.			50 Mil.			60 Mil.			70 Mil.			80 Mil.		
	d.	m.	f.	d.	m.	f.	d.	m.	f.	d.	m.	f.	d.	m.	f.	d.	m.	f.
0	0	30	0	0	40	0	0	50	0	1	0	0	1	10	0	1	20	0
1	0	30	0	0	40	0	0	50	0	1	0	1	1	10	1	1	20	1
2	0	30	1	0	40	1	0	50	1	1	0	2	1	10	3	1	20	3
3	0	30	2	0	40	3	0	50	4	1	0	5	1	10	6	1	20	7
4	0	30	4	0	40	6	0	50	7	1	0	9	1	10	10	1	20	12
5	0	30	7	0	40	9	0	50	11	1	0	14	1	10	16	1	20	18
6	0	30	9	0	40	13	0	50	16	1	0	19	1	10	21	1	20	24
7	0	30	13	0	40	18	0	50	22	1	0	27	1	10	31	1	20	35
8	0	30	17	0	40	23	0	50	28	1	0	34	1	10	40	1	20	46
9	0	30	22	0	40	30	0	50	37	1	0	45	1	10	52	1	20	59
10	0	30	28	0	40	37	0	50	46	1	0	55	1	11	05	1	21	14
11	0	30	34	0	40	45	0	50	56	1	1	07	1	11	19	1	21	30
12	0	30	40	0	40	53	0	51	06	1	1	20	1	11	33	1	21	46
13	0	30	47	0	41	03	0	51	19	1	1	35	1	11	50	1	22	06
14	0	30	55	0	41	13	0	51	31	1	1	50	1	12	09	1	22	27
15	0	31	03	0	41	24	0	51	46	1	2	07	1	12	28	1	22	49
16	0	31	13	0	41	37	0	52	01	1	2	26	1	12	50	1	23	14
17	0	31	21	0	41	49	0	52	16	1	2	43	1	13	11	1	23	38
18	0	31	33	0	42	04	0	52	34	1	3	05	1	13	36	1	24	07
19	0	31	44	0	42	18	0	52	53	1	3	27	1	14	01	1	24	37
20	0	31	55	0	42	34	0	53	12	1	3	51	1	14	29	1	25	08
21	0	32	08	0	42	51	0	53	33	1	4	16	1	14	59	1	25	41
22	0	32	21	0	43	09	0	53	56	1	4	43	1	15	30	1	26	17
23	0	32	35	0	43	27	0	54	19	1	5	11	1	16	03	1	26	55
24	0	32	50	0	43	47	0	54	44	1	5	41	1	16	27	1	24	24

Westing into Degrees of Longitude.

5	0 33 06	0 44 08	0 55 10	1 6 12	1 17 14	1 28 18
6	0 33 22	0 44 30	0 55 37	1 6 44	1 17 51	1 28 58
7	0 33 10	0 44 53	0 56 07	1 7 20	1 18 33	1 29 47
8	0 33 56	0 45 16	0 56 35	1 7 55	1 19 14	1 30 34
9	0 34 18	0 45 44	0 57 10	1 8 36	1 20 02	1 31 28
0	0 34 38	0 46 11	0 57 48	1 9 17	1 20 49	1 32 23
1	0 34 58	0 46 38	0 58 18	1 9 58	1 21 37	1 33 18
2	0 35 22	0 47 10	0 58 57	1 10 45	1 22 32	1 34 20
3	0 35 46	0 47 41	0 59 37	1 11 42	1 23 37	1 35 33
4	0 36 11	0 48 15	1 00 19	1 12 22	1 24 26	1 36 31
5	0 36 37	0 48 50	1 01 02	1 13 14	1 25 26	1 37 48
6	0 37 05	0 49 27	1 01 48	1 14 10	1 26 32	1 38 53
7	0 37 34	0 50 05	1 02 37	1 15 8	1 27 39	1 40 11
8	0 38 04	0 50 45	1 03 27	1 16 8	1 28 49	1 41 31
9	0 38 36	0 51 28	1 04 20	1 17 12	1 30 04	1 42 56
0	0 39 09	0 52 13	1 5 16	1 18 19	1 31 22	1 44 20
1	0 39 45	0 53 00	1 6 15	1 19 30	1 32 45	1 46 00
2	0 40 22	0 53 49	1 7 17	1 20 44	1 34 11	1 47 38
3	0 41 17	0 54 49	1 8 32	1 22 14	1 35 56	1 49 39
4	0 41 42	0 55 37	1 9 30	1 23 25	1 37 19	1 51 13
5	0 42 24	0 56 33	1 10 41	1 24 50	1 38 58	1 53 07
6	0 43 11	0 57 39	1 11 58	1 26 22	1 40 45	1 55 09
7	0 43 59	0 58 34	1 13 19	1 27 59	1 42 38	1 57 18
8	0 44 50	0 59 47	1 14 43	1 29 40	1 44 36	1 59 33
9	0 45 33	1 00 57	1 16 11	1 31 26	1 46 40	2 01 54
0	0 46 40	1 02 14	1 17 47	1 33 21	1 48 54	2 04 28
1	0 47 40	1 03 33	1 19 27	1 35 20	1 51 13	2 07 07
2	0 48 43	1 04 58	1 21 12	1 37 27	1 53 41	2 09 55

The Use of this Table for reducing Mil Easting or Westing into Degrees an Minutes of Longitude.

IF the Miles given be under ten, or consists of ju tens, as 10, 20, 30, 40, *&c.*

Look the Latitude down along the left hand edge u der Parall. and the Miles in the Head of the Table, an in the common Angle of meeting, are the Degrees, m nutes and seconds of Longitude, answering to so muc Easting or Westing in that Latitude: As

Admit a Ship sail fifty Miles East or West in the Pa rallel of fifty degrees of Latitude; how many degrees o Longitude doth it make?

Look fifty minutes on the Head of the Table, and run ning down the Column till you come against fifty Lat you'll find 1 deg, 17 min. 47 sec.

But if the Miles Easting or Westing be a compound number above ten, then break it into its articulate num-bers, or into such parts as may be found on the head of the Table: and therewith make several Entries, taking out the corresponding difference of Longitude, the sum of all which differences will be the whole difference of Longitude answering to the given Easting or Westing. As admit a Ship has made 75 miles Easting in the Pa-rallel of 48 deg. 00 min. Lat.

	deg.	min.	sec.
70 Miles gives	1	44	36
5 gives	0	07	28
Their Sum	1	52	04

it the difference of Longitude answering to 75 minutes Easting in 40 degrees Lat.

Suppose

Suppose there be required the Degrees of Longitude
wering to 145 miles, East or West in the Lat. 42 deg.
min.

	deg.	min.	sec.
gives	1	34	11
gives	1	34	11
gives	0	06	44
e Difference	3	15	06

Admit I being 1500 Miles West from the Meridi-
of *London*, and in the Latitude 53 deg. 00 min, see
Eclipse of the Moon begin at 30 deg. after eight of
e Clock at night, and would know what of the Clock
s then at *London*.

	deg.	m.	sec.
miles gives	2	12	56
gives	1	56	19
150 miles gives	4	09	15
hich multiplied by 10, makes	41	32	30

	deg.	h.	m.	sec.
nen say	15	1	41	$32\frac{1}{2}$
	60		60	
	900		2492	
	2		2	
	18.00		4985	
			1345	
			60	
			807.00	
			185	
			160	
			900	

The

The time at *London* 11 hours, 48 minutes, 10

h.	m.	sec.
2	44	50
8	30	00
11	14	50

Being to the Eaſtward of *London* in the Latitude 53 degrees, ſee the beginning of an Eclipſe at 14 m 50 ſec. after 11 of the clock at night: but the beginni happened at *London*, as I am inform'd, at 8 h. 30 m how many miles am I to the Eaſtward of *London*?

	h.	m.	sec.
From	11	14	50
Subſtract	8	30	00
Reſt	3	44	50

Then ſay if 1 h. 15 deg. 2 h. 44 min. 50 ſec. an there comes 41 deg. 32 min. 30 ſec. and looking in th Table againſt 53 deg. Lat. under 1 mile is 1 min. 40 ſe then again ſay 1 deg. 40 ſec. 1 min. 41 deg. 32 mi 30 ſec. and there comes 1496 miles, which ought t have been 1500, but 1 min. 40 ſec is too much by a about half a ſecond, which cauſes this difference.

Being in the Latitude 48 deg. and to the Weſtward o *London*, I ſaw exactly at 9 h. 40 min. 30 ſec. after noon the Moons Eaſtermoſt Limb or Edge juſt come upon *Aldebaran*, the time of the ſame appearance at *London*, I am informed, was at 11 h. 14 min. 50 ſec. after noon, what was my difference of Longitude from *London*, and how many miles was I thence?

The hour of the night, 9 h. 40 min. 30 ſec. was found by

taking the heighth of the Star juſt at the inſtant of
: Appulſe.

	h.	m.	ſec.
From	11	14	50
Take	9	40	30
Remainder	1	34	20

Say 1 h. 15 deg. 1 h. 34 min. 20 ſec. and there
mes 23 deg. 35 min. the Diff. of Longitude; then
oking in the Table againſt 48 deg. Lat. under 1 mile is 1
in. 30 ſec. then again ſay,
deg. 30 ſec. 1 min. 23 deg. 35 min. and there comes
43 miles, the diſtance between the Ship and Meridian of
ndon.

A Table.

A Table of Meridional Miles.

Deg. of Lat.	*The Minutes of each Degree.*						Difference.
	0	10	20	30	40	50	
	The Meridional Miles.						
0	0	10	20	30	40	50	10
1	60	70	80	90	100	110	10
2	120	130	140	150	160	170	10
3	180	190	200	210	220	230	10
4	240	250	260	270	280	290	10
5	300	310	320	330	340	350	10
6	360	370	380	390	400	410	10
7	421	431	441	451	461	471	10
8	481	491	501	511	521	532	10
9	542	552	562	572	582	592	10
10	603	613	623	633	643	653	10
11	664	674	684	694	704	715	10
12	725	735	745	755	766	776	10
13	786	797	807	817	827	838	10
14	848	858	869	879	889	900	10
15	910	920	931	941	951	962	10
16	972	983	993	1004	1014	1024	10
17	1035	1045	1056	1066	1077	1087	10
18	1098	1108	1119	1129	1140	1150	10
19	1161	1172	1182	1193	1203	1214	10
20	1225	1235	1246	1257	1267	1278	11
21	1289	1299	1310	1321	1332	1342	11
22	1353	1364	1375	1386	1396	1407	11
23	1418	1429	1440	1451	1462	1473	11
24	1484	1495	1505	1516	1527	1538	11
25	1549	1561	1572	1583	1594	1605	11
26	1616	1627	1638	1649	1661	1672	11
27	1683	1694	1705	1717	1728	1738	11
28	1751	1762	1773	1785	1796	1808	11
29	1819	1830	1842	1853	1865	1877	11

A Table of Meridional Miles.

The Minutes of each Degree.

	0	10	20	30	40	50	Difference.
	The Meridional Miles.						
0	1888	1899	1911	1923	1934	1946	12
1	1958	2969	1981	1993	2004	2016	12
2	2028	2040	2052	2063	2075	2087	12
3	2099	2111	2123	2135	2147	2159	12
4	2171	2183	2195	2207	2219	2231	12
5	2244	2256	2268	2281	2293	2305	12
6	2318	2330	2342	2355	2367	2380	12
7	2392	2405	2417	2430	2442	2455	12
8	2468	2481	2493	2506	2519	2532	13
9	2544	2557	2570	2583	2596	2609	13
10	2622	2635	2648	2662	2675	2688	13
11	2701	2714	2728	2741	2754	2768	13
12	2781	2795	2808	2822	2835	2849	13
13	2863	2876	2890	2904	2918	2932	14
14	2945	2959	2973	2987	3001	3015	14
15	3030	3044	3058	3072	3086	3101	14
16	3115	3130	3144	3159	3173	3188	14
17	3202	3217	3232	3247	3261	3276	15
18	3291	3306	3321	3336	3351	3366	15
19	3382	3397	3412	3428	3443	3459	15
20	3474	3490	3505	3521	3537	3553	16
21	3568	3584	3600	3616	3632	3649	16
22	3665	3681	3697	3714	3730	3747	16
23	3763	3780	3797	3814	3830	3847	17
24	3864	3881	3899	3916	3933	3950	17
25	3968	3985	4003	4020	4038	4056	18
26	4074	4092	4110	4128	4146	4164	19
27	4182	4201	4219	4238	4257	4275	19
28	4294	4313	4332	4351	4370	4390	20
29	4409	4428	4468	4461	4487	4507	20

A Table of Meridional Miles.

The Minutes of each Degree.

Deg. of Lat.	0	10	20	30	40	50	Diff.
	The Meridional Miles.						
60	4527	4547	4567	4588	4608	4629	2
61	4648	4670	4691	4711	4733	4754	2
62	4775	4796	4818	4839	4861	4883	2
63	4905	4927	4949	4972	4994	5017	2
64	5039	5062	5085	5108	5132	5155	2
65	5179	5203	5226	5250	5275	5299	2
66	5324	5348	5373	5390	5423	5449	2
67	5474	5500	5520	5552	5678	5404	2
68	5631	5658	5685	5712	5739	5767	2
69	5795	5823	5021	5879	5908	5937	2
70	5966	5996	6125	6055	6085	6115	3
71	6146	6177	6208	6239	6271	6303	3
72	6335	6368	6401	6434	6468	6501	3
73	6535	6570	6605	6640	6675	6718	3
74	6747	6783	6820	6857	6895	6933	3
75	6972	7010	7050	7089	7130	7170	4
76	7211	7253	7295	7338	7381	7424	4
77	7469	7513	7559	7605	7651	7698	4
78	7746	7795	7844	7894	7944	7996	5
79	8048	8100	8154	8209	8264	8320	5
80	8377	8435	8495	8555	8616	8678	6
81	8742	8806	6872	8939	9007	9077	6
82	9148	9221	9295	9371	9449	9528	7
83	9609	9692	9778	9865	9954	10046	8
84	10141	10238	10338	10441	10547	10656	10
85	10770	10887	11007	11133	11263	11398	12
86	11539	11686	11839	11999	12168	12344	16
87	12521	12718	12927	13150	13388	13644	23
88	13920	14221	14550	14914	15321	15783	38
89	16318	16950	17726	18729	20152	22623	

A Table of Proportional Parts.

	1	2	3	4	5	6	7	8	9
	1	2	3	4	5	6	7	8	9
	1	2	3	4	5	7	8	9	10
	1	2	4	5	6	7	8	10	11
	1	3	4	5	7	8	9	10	12
	1	3	4	6	7	8	10	11	13
	1	3	4	6	7	9	10	12	13
	2	3	5	6	8	10	11	13	14
	2	3	5	7	8	10	12	14	15
	2	4	5	7	9	11	13	14	16
	2	4	6	8	9	11	13	15	17
	2	4	6	8	10	12	14	16	18
	2	4	6	8	10	13	15	17	19
	2	4	7	9	10	13	15	18	20
	2	5	7	9	11	14	16	18	21
	2	5	7	10	12	14	17	19	22
	2	5	7	10	12	15	17	20	22
	3	5	8	10	13	16	18	21	23
	3	5	8	11	13	16	19	22	24
	3	6	8	11	14	17	20	22	25
	3	6	9	12	15	18	21	24	27
	3	7	10	13	16	20	23	26	30
	3	7	10	14	17	21	24	28	31
	4	7	11	15	18	22	26	30	33
	5	8	12	16	20	24	28	32	36
	5	11	16	22	27	33	38	44	49
	6	12	18	24	30	36	42	48	54
	6	13	20	27	34	40	47	54	61
	7	15	23	30	38	46	53	61	69
	8	17	26	35	44	52	61	70	79
	10	21	31	42	52	63	73	84	94
	12	25	38	51	64	76	89	102	115
	16	33	49	66	82	99	115	132	148
	23	46	69	92	115	138	161	184	207
	28		115	154	102	221	270	208	347

A Table of the Right Aſcenſions and D
clinations of the moſt notable fixed Star
for the year 1700, with their Differenc
in a hundred years.

	Names of the Stars.	Right Aſcen.		Decli-nation		D. R.
		H.	M.	D.	M.	M.
3	IN *Caſſiopeia*'s Breaſt.	0	24	54	55	6
2	The Pole Star.	0	39	87	43	16
2	The Southermoſt in the *whales* tail	0	29	13	38	5
2	*Andromeda*'s Girdle	0	53	34	05	5
3	*Caſſiopeia*'s Knee	1	07	58	40	6
3	The *whales* Belly.	1	37	11	45	5
2	The South Foot of *Andromeda*	1	46	40	53	6
3	The bright Star of *Aries*	1	51	22	03	6
2	In the *whales* Chap	2	47	02	54	5
3	*Meduſa*'s Head	2	49	39	47	6
2	*Perſeus* bright Side.	3	02	48	43	6
3	The brighteſt of the *Pleiades*	3	30	23	30	6
3	The North Eye of *Taurus*	4	11	18	31	6

Names of the Sars.	Right Aſcen		Decli-natio.		D. R	D. D.
	H.	M.	D.	M.	m.	m.
Aldebaran, or the South Eye of *Taurus*	4	19	15	53	6	15
The Goat *Capella*	4	55	45	40	7	10
The bright foot of *Orion Regel*	5	01	8	33	5	9
The North Horn of *Taurus*	5	08	28	20	6	8
Orion's left Shoulder	5	09	6	03	5	8
1. In *Orion*'s Girdle	5	17	0	32	5	7
The Bull's South Horn	5	20	20	58	6	9
2. In *Orion*'s Girdle.	5	21	01	24	5	6
3. In *Orion*'s Girdle.	5	26	02	07	5	5
The right ſhoulder of *Auriga*	5	38	44	54	8	4
The bright foot of *Gemini*	6	20	16	38	6	2
The great Dog *Sirius*	6	32	16	15	5	4
The upper Head of *Gemini*	7	16	32	30	7	11
The leſſer Dog *Procyon*	7	24	6	00	5	12
The lower Head of *Gemini*	7	31	28	43	6	12
Hydra's Heart	9	13	7	22	5	25
The Lion's Heart *Baſiliſcus*	9	53	13	25	5	28
The lower Pointer	10	44	58	15	7	32
The middlemoſt in the Lion's Neck	10	00	21	21	6	29
The upper Pointer	10	46	63	38	7	32
The Lion's tail	11	24	16	15	5	34
The Root of the great Bear's tail	12	41	57	37	5	33
Virgin's Spike	13	10	09	33	5	32
The laſt but one in the great Bear's tail	13	12	56	31	4	32
The laſt in the great Bear's tail	13	36	50	51	4	31
Arcturus	14	02	20	49	5	29

	The Names of the Stars.	Right Aſcen. H. M.	Decli-natio. D. M	D. R. m.
2	The South balance	14 34	14 45	5
2	The foremoſt Guard	14 51	75 36	
2	The North Balance.	15 01	8 74	5
2	Bright Star of the Crown	15 22	27 45	4
	The hindermoſt Guard	15 31	73 25	
2	The bright ſtar in the ſerpent's Neck	15 30	7 25	5
3	The left hand of *Ophiuchus*	15 59	2 55	
1	*Scorpion*'s heart, *Antares*	16 11	25 42	6
3	*Hercules* right ſhoulder.	16 17	22 12	4
3	The left knee of *Ophiuchus*	16 21	9 54	5
3	The right knee of *Ophiuchus*	16 51	15 17	3
3	*Hercules* his head	17 01	14 47	4
3	*Hercules* left ſhoulder	17 02	25 14	4
3	The head of *Ophiuchus*	17 21	12 49	5
3	The right ſhoulder of *Ophiuchus*	17 29	4 44	5
3	The bright ſtar in the Dragon's head	17 50	51 35	2
1	*Lyra*	18 27	38 32	3
3	The Vulture's tail.	18 52	23 28	5
3	The Swan's beak	19 19	27 21	4
2	The bright ſtar of the Vulture	19 36	8 07	5
3	The upper horn of *Capricorn*	20 01	13 24	6
3	The lower horn of *Capricorn*	20 04	15 40	6
3	The Swan's breaſt	20 12	39 19	4
4	The left hand of *Aquarius*.	20 31	10 34	5
2	The Swan's tail	20 31	44 14	3
3	The Swan's lower wing	20 34	32 51	4
3	The left ſhoulder of *Aquarius*	21 16	6 49	4
3	The Girdle of *Cepheus*	21 25	69 16	1

The Names of the Stars.	Right Aſcen.		Decli-natio.		R. D. D.	D. m.
	H.	M	D.	M.	m.	m.
Pegaſus Mouth	21	30	8	31	5	26
The bright ſhoulder of *Aquarius*	21	51	1	44	5	29
Fomahant	22	41	31	08	6	31
Scheat	22	49	26	28	5	32
Morchab	22	50	13	37	5	32
Andromeda's Head.	23	53	27	28	5	34

the right Aſcenſion be leſs than ſix hours, or more than eighteen hours, the Declination of thoſe ſtars t are to the North of the Equinoctial muſt be increa- by the Difference for time to come; and the Southern rs Declinations decreaſed: but in the other Hemi- ere where the Right Aſcenſion is more than ſix hours, eſs than eighteen hours, the contrary.

The Traverse Table for

	1 Deg.	89 De.	3 Deg.	87 De.	5 De.	85 D
dist	M. Par.	M. P.	M. P.	M. P.	M. P.	M.
1	1 00	57 60	1 00	19 10	1 01	11
2	2 00	144 60	2 00	38 20	2 01	22
3	3 00	171 00	3 00	57 30	3 01	34
4	4 00	229 20	4 01	76 40	4 02	45
5	5 00	286 50	5 01	95 50	5 02	57
6	6 00	343 80	6 01	114 60	6 03	68
7	7 00	401 10	7 01	133 70	7 03	80
8	8 00	458 40	8 01	152 80	8 03	91
9	9 00	515 70	9 01	171 90	9 03	103
10	10 00	573 00	10 01	191 00	10 04	114
20	20 00	1146 00	20 03	382 00	20 08	229
30	30 00	1719 00	30 04	573 50	30 11	341
40	40 01	2292 00	40 06	764 50	40 15	459
50	50 01	2865 00	50 07	955 00	50 19	574
60	60 01	3438 00	60 08	1146 00	60 23	688
70	70 01	4011 00	70 10	1337 00	70 28	803
80	80 01	4584 00	80 11	1528 00	80 30	918
90	90 01	5157 00	90 13	1719 00	90 34	1033
100	100 02	5730 00	100 14	1910 00	100 38	1148

	20 De.		70 De.		4 De.		86 De.		6 De.		84 De.	
	M.	p.	M.	p.	M.	p.	M.	p.	M.	p.	M.	p.
1	1	00	28	65	1	00	14	34	1	01	9	57
2	2	00	57	30	2	00	28	68	2	01	18	13
3	3	00	85	95	3	01	43	02	3	02	28	70
4	4	00	114	60	4	01	57	36	4	03	38	27
5	5	00	143	25	5	01	71	70	5	03	47	83
6	6	00	171	90	6	01	85	04	6	03	57	40
7	7	00	200	55	7	02	100	38	7	04	66	97
8	8	00	229	20	8	02	114	72	8	04	76	53
9	9	00	257	85	9	02	129	06	9	05	86	10
10	10	01	286	50	10	02	143	40	10	06	95	67
20	20	01	573	00	20	05	286	80	20	11	191	33
30	30	02	859	50	30	07	430	20	30	16	287	00
40	40	02	1146	00	40	10	573	60	40	22	382	67
50	50	03	1432	50	50	12	717	00	50	28	478	34
60	60	04	1719	00	60	14	860	40	60	33	574	01
70	70	04	2005	50	70	17	1003	80	70	39	669	68
80	80	05	2292	00	80	19	1147	16	80	44	765	34
90	90	05	2578	50	90	22	1290	60	90	50	861	01
100	100	06	2865	00	100	24	1434	00	100	55	956	68

The Traverse Trable for

	7 Deg.		83 De.		9 Deg.		81 De.		11 De.		79 D
dist.	M.	Par.	M.	P.	M.	P.	M.	P.	M.	P.	M.
1	1	01	8	21	1	02	6	39	1	02	5
2	2	01	16	41	2	03	12	78	2	04	10
3	3	02	24	62	3	04	19	58	3	06	15
4	4	03	32	82	4	05	25	37	4	07	20
5	5	04	41	03	5	06	31	96	5	09	26
6	6	04	49	23	6	07	38	35	6	11	31
7	7	05	57	44	7	09	44	75	7	13	36
8	8	06	65	64	8	10	51	14	8	15	41
9	9	07	73	85	9	11	57	53	9	17	47
10	10	08	82	06	10	12	63	93	10	19	52
20	20	15	164	11	20	25	127	85	20	37	104
30	30	22	246	16	30	37	191	77	30	56	157
40	40	30	328	22	40	50	255	69	40	75	209
50	50	37	410	28	50	62	319	61	50	94	262
60	60	45	492	33	60	75	383	54	61	12	314
70	70	53	574	38	70	87	447	47	71	31	366
80	80	60	656	44	81	00	511	49	81	50	419
90	90	68	738	49	91	12	575	32	91	68	471
100	100	75	820	55	101	25	639	25	101	87	524

8 Deg.		8 De.		10 De.		80 De.		12 De.		87 De	
M.	P.	M.	P.	M.	P.	M.	P.	M.	P.	M.	P.
1	01	7	18	1	02	5	76	1	02	4	81
2	02	14	37	2	03	11	52	2	04	9	62
3	03	21	56	3	05	17	28	3	07	14	43
4	04	28	74	4	06	23	04	4	09	19	24
5	05	35	92	5	08	28	80	5	11	24	05
6	06	43	11	6	09	34	55	6	13	28	86
7	07	50	30	7	11	40	31	7	16	33	67
8	08	57	48	8	12	46	07	8	18	38	47
9	09	64	67	9	14	51	83	9	20	43	28
10	10	71	85	10	15	57	59	10	22	48	09
20	20	143	70	20	31	115	18	20	45	96	19
30	29	215	56	30	46	172	76	30	67	144	28
40	39	287	41	40	62	230	35	40	89	192	37
50	49	359	27	50	77	287	94	51	12	240	47
60	59	431	12	60	93	345	53	61	34	288	56
70	69	502	97	71	08	403	12	71	56	336	66
80	79	574	82	81	23	460	70	81	78	384	75
90	88	646	68	91	39	518	29	92	01	432	84
100	98	718	53	101	54	575	88	102	23	480	94

The Traverse Table for

	13 De.		77 De.		15 De.		75 De.		17 De.		73
dif	M.	p.	M.	p.	M.	p.	M.	p.	M.	p.	M.
1	1	02	4	45	1	04	3	86	1	05	3
2	2	05	8	89	2	07	7	73	2	09	6
3	3	08	14	34	3	11	11	56	3	14	10
4	4	10	17	78	4	14	15	45	4	18	13
5	5	13	22	23	5	18	19	32	5	23	17
6	6	16	26	66	6	21	23	18	6	27	20
7	7	18	31	12	7	25	27	05	7	32	23
8	8	21	35	56	8	28	30	91	8	37	27
9	9	24	40	00	9	32	34	77	9	41	30
10	10	26	44	45	10	35	38	64	10	46	34
20	20	53	88	91	20	71	77	28	20	91	68
30	30	79	133	26	31	06	115	91	31	37	102
40	41	05	177	82	41	41	154	55	41	83	136
50	51	32	222	27	51	76	193	18	52	28	171
60	61	58	266	72	62	12	231	82	62	74	205
70	71	84	311	18	72	47	270	46	73	20	239
80	82	10	355	63	82	82	309	10	83	66	273
90	92	37	400	09	93	18	347	73	94	11	307
100	102	63	444	54	103	53	386	37	104	57	342

14 De.		76 De.		16 De.		74 De.		18 De.		72 De.	
M.	p.	M.	p.	M.	p.	M.	p.	M.	2.	M.	p.
1	03	4	13	1	04	3	63	1	05	3	24
2	06	8	26	2	08	7	26	2	10	6	47
3	09	12	40	3	12	10	88	3	15	9	71
4	12	16	53	4	16	14	51	4	21	12	94
5	15	20	67	5	20	18	14	5	26	16	18
6	18	24	80	6	24	21	77	6	31	19	42
7	21	38	94	7	28	25	40	7	36	22	65
8	24	33	07	8	32	29	02	8	41	25	89
9	28	37	20	9	36	32	65	9	46	29	12
10	31	41	33	10	40	36	28	10	51	32	36
20	61	82	67	20	81	72	56	21	03	64	72
30	92	124	01	31	21	108	84	31	54	97	08
41	22	165	34	41	61	145	12	42	06	129	44
51	53	206	68	52	01	181	40	52	57	161	80
61	84	248	01	62	42	217	68	63	09	194	16
72	14	289	35	72	82	253	96	73	60	226	52
82	45	330	69	83	22	290	24	84	12	258	88
92	75	372	02	93	63	326	52	94	63	291	25
103	06	413	36	104	03	362	80	105	15	323	61

The Traverse Table for

	19 De.		71 De.		21 De.		69 De.		23 De.		61 D	
dif.	M.	P.	M.	P.	M.	p.	M.	p.	M.	p.	M.	
1	1	06	3	07	1	07	2	79	1	09	2	
2	2	11	6	14	2	14	5	58	2	17	5	
3	3	17	9	21	3	21	8	37	3	26	7	
4	4	23	12	29	4	28	11	16	4	35	10	
5	5	29	15	36	5	36	13	95	5	43	12	
6	6	35	18	43	6	43	16	74	6	52	15	
7	7	40	21	50	7	50	19	53	7	60	17	
8	8	46	24	57	8	57	22	32	8	69	20	
9	9	52	27	64	9	64	25	11	9	78	23	
10	10	58	30	72	10	71	27	90	10	86	25	
20	21	15	61	43	21	42	55	81	21	73	51	
30	31	73	92	15	32	13	83	71	32	59	76	
40	42	30	122	86	42	84	111	62	43	45	102	
50	52	88	153	58	53	56	139	52	54	32	127	
60	63	46	184	29	64	27	167	43	65	18	153	
70	74	03	215	01	74	98	195	33	76	05	179	
80	84	61	245	72	85	69	223	24	86	91	204	
90	95	19	276	44	96	40	251	14	97	77	203	
100	105	76	307	16	107	11	279	04	108	64	255	

20 De.		70 De.		22 De.		68 De.		24 De.		66 De.	
M.	p.	M.	p.	M.	p.	M.	p.	M.	p.	M.	p.
1	06	2	92	1	08	2	67	1	09	2	45
2	13	5	85	2	16	5	34	2	19	4	92
3	19	8	77	3	24	8	01	3	28	7	38
4	26	11	70	4	31	10	68	4	38	9	83
5	32	14	62	5	39	13	35	5	47	12	29
6	39	17	54	6	47	16	02	6	57	14	75
7	45	20	47	7	55	18	69	7	66	17	21
8	51	23	39	8	63	21	36	8	76	19	67
9	58	26	31	9	71	24	03	9	85	22	13
10	64	29	24	10	79	26	07	01	95	24	59
21	28	58	48	21	57	53	40	21	89	49	17
31	93	87	71	32	36	80	08	32	84	73	76
42	57	116	95	43	14	106	78	43	78	98	34
53	21	146	18	53	93	133	47	54	73	122	93
63	85	175	43	64	71	160	17	65	68	147	52
74	49	204	67	75	50	186	86	76	62	172	10
85	13	233	90	86	28	213	56	87	57	196	69
95	78	263	14	97	07	240	25	98	51	221	27
106	42	290	38	107	85	266	95	109	46	245	86

The Traverse Table for

	25 De.		65 De.		27 De.		63 De.		23 De.		61
dist.	M.	p.	M.	p.	M.	p.	M.	p.	M.	p.	M.
1	1	10	2	37	1	12	2	20	1	14	2
2	2	21	4	73	2	24	4	40	2	29	4
3	3	31	7	10	3	37	6	61	3	43	6
4	4	41	9	47	4	49	8	81	4	57	8
5	5	52	11	83	5	61	11	01	5	72	10
6	6	62	14	20	6	73	13	22	6	86	12
7	7	72	16	56	7	86	15	42	8	00	14
8	8	83	18	93	8	98	17	62	9	15	16
9	9	93	21	30	10	10	19	82	10	29	18
10	11	03	23	66	11	22	22	03	11	43	20
20	22	07	47	32	22	45	44	05	22	87	41
30	33	10	70	99	33	67	66	08	34	30	61
40	44	14	94	65	44	89	88	11	45	73	82
50	55	17	118	31	56	12	110	14	57	17	103
60	66	20	141	97	67	34	132	16	68	60	123
70	77	24	165	63	78	56	154	19	80	03	144
80	88	27	189	30	89	79	176	22	91	47	165
90	99	30	212	96	101	01	198	24	102	90	185
100	110	34	236	62	112	23	220	27	114	34	206

	26 De.	64 De.	28 De.	62 De.	30 De.	60 De.
if.	M. P.	M. P.	M. P.	M. P.	M. P.	M. P.
1	1 11	2 28	1 13	2 13	1 15	2 00
2	2 23	4 56	2 27	4 26	2 31	4 00
3	3 34	6 84	3 40	6 39	3 46	6 00
4	4 45	9 12	4 53	8 52	4 62	8 00
5	5 56	11 41	5 66	10 65	5 77	10 00
6	6 68	13 69	6 80	12 78	6 93	12 00
7	7 79	15 97	7 93	14 91	8 08	14 00
8	8 90	18 25	8 06	17 04	9 24	16 00
9	10 01	20 53	10 19	19 17	10 39	18 00
10	11 13	22 81	11 33	21 30	11 55	20 00
20	22 25	45 62	22 65	42 60	23 09	46 00
30	33 38	68 44	33 98	63 90	34 64	60 00
40	44 50	91 25	45 30	85 20	46 19	80 00
50	55 63	114 06	56 63	106 50	57 73	100 00
60	66 76	136 87	67 95	127 80	69 29	120 00
70	77 88	159 68	70 28	149 10	80 83	140 00
80	89 01	182 49	90 61	170 40	92 38	160 00
90	101 13	205 31	101 93	191 70	103 92	180 00
00	111 26	228 12	113 26	213 00	115 47	200 00

The Traverse Table for

	31 De.		9 De.		33 De.		57 De.		35 De.		55 D	
dif.	M.	p.	M.	p.	M.	p.	M.	p.	M.	p.	M.	
1	1	17	1	94	1	19	1	84	1	22	1	
2	2	33	3	88	2	38	3	67	2	44	3	
3	3	50	5	82	3	58	5	51	3	66	5	
4	4	67	7	77	4	77	7	34	4	88	6	
5	5	83	9	71	5	96	9	18	6	10	8	
6	7	00	11	65	7	15	11	02	7	32	10	
7	8	17	13	59	8	35	12	85	8	55	12	
8	9	33	15	53	9	54	14	69	9	77	13	
9	10	50	17	47	10	73	16	52	10	99	15	
10	11	67	19	42	11	92	18	36	12	21	17	
20	23	33	38	83	23	85	36	72	24	42	24	
30	35	00	58	25	35	77	55	08	36	62	52	
40	46	67	77	66	47	70	73	44	48	83	69	
50	58	33	97	08	59	62	91	80	61	04	87	
60	70	00	116	50	71	54	110	17	73	25	104	
70	81	66	135	91	83	47	128	53	85	46	122	
80	93	33	155	33	95	39	146	89	97	66	139	
90	105	00	174	74	107	32	165	25	109	87	156	
100	116	66	194	16	119	24	183	61	122	08	174	

32 De.		58 De.		34 De.		56 De.		36 De.		54 De.	
M.	p.	M.	p.	M.	p.	M.	p.	M.	2.	M.	p.
1	18	1	89	1	21	1	79	1	24	1	70
2	36	3	77	2	41	3	58	2	47	3	40
3	54	5	66	3	62	5	36	3	71	5	10
4	72	7	55	4	82	7	15	4	94	6	80
5	90	9	44	6	03	8	94	6	18	8	51
7	08	11	32	7	24	10	73	7	42	10	21
8	25	13	21	8	44	12	52	8	65	11	91
9	43	15	10	9	65	14	31	9	89	13	61
10	61	16	98	10	86	16	09	11	12	15	31
11	79	18	87	12	06	17	88	12	36	17	02
23	58	37	74	24	12	35	77	24	72	34	03
35	38	56	61	36	19	53	65	37	08	51	04
47	17	75	48	48	25	71	53	49	45	68	05
58	96	94	35	60	31	89	42	61	80	85	06
70	75	113	22	72	37	107	30	74	17	102	08
82	54	132	10	84	43	125	18	86	53	119	09
94	33	150	97	96	50	143	05	18	89	136	10
106	13	169	84	108	56	160	95	111	25	153	12
117	93	188	71	120	62	178	83	123	61	170	13

The Traverse Table for

	37 De.		53 De.		39 De.		51 De.		41 De.		49 D	
dif.	M.	p.	M.	p.	M.	p.	M.	p.	M.	p.	M.	
1	1	25	1	66	1	29	1	59	1	32	1	
2	2	50	3	32	2	57	3	18	2	65	3	
3	3	76	4	98	3	86	4	77	3	97	4	
4	5	01	6	65	5	15	6	36	5	30	6	
5	6	26	8	31	6	43	7	95	6	62	7	
6	7	51	9	97	7	72	9	10	7	95	9	
7	8	76	11	63	9	01	11	12	9	27	10	
8	10	02	13	29	10	29	12	71	10	60	12	
9	11	27	14	95	11	58	14	30	11	92	13	
10	12	52	16	62	12	87	15	89	13	25	15	
20	25	04	33	23	25	73	31	78	26	50	30	
30	37	56	49	85	38	60	47	67	39	75	45	
40	50	09	66	47	51	47	63	56	50	00	60	
50	62	62	83	08	64	34	79	45	66	25	76	
60	75	13	99	70	77	21	95	34	79	50	91	
70	87	65	116	31	90	08	111	23	92	75	106	
80	100	17	132	93	102	94	127	12	106	00	121	
90	112	70	149	55	115	81	143	01	119	25	177	
100	125	22	166	16	128	63	158	90	132	50	152	

th

38 De.		52 De.		40 De.		50 De.		42 De.		48 De.	
M.	p.	M.	p.	M.	p.	M.	p.	M.	p.	M.	p.
1	27	1	62	1	31	1	56	1	35	1	49
2	54	3	25	2	61	3	11	2	69	2	99
3	81	4	87	3	92	4	67	4	04	4	48
5	08	6	50	5	22	6	22	5	38	5	98
6	34	8	12	6	53	7	78	6	73	7	47
7	61	9	75	7	83	9	33	8	07	8	97
8	88	11	37	9	13	10	89	9	42	10	46
10	15	12	99	10	44	12	45	10	76	11	96
11	42	14	62	11	75	14	00	12	11	13	45
12	69	16	24	13	05	15	56	13	46	14	44
25	38	32	49	26	11	31	11	26	91	29	89
38	07	48	73	39	16	46	67	40	37	44	83
50	76	64	97	52	22	62	23	53	83	59	78
63	45	81	21	65	27	77	78	67	28	74	72
76	14	97	46	78	32	93	34	80	74	89	67
89	83	113	70	91	38	108	90	94	19	104	61
101	52	129	94	104	43	124	46	107	65	119	56
114	21	146	19	117	49	140	01	121	11	134	50
126	40	162	43	130	54	155	57	134	56		

A Table for the true Chart.

dif.	43 De. M.	p.	47 De. M.	p.	44 De. M.	p.	46 De. M.	p.	45 De. M.	p.
1	1	37	1	47	1	39	1	44	1	41
2	2	75	2	93	2	78	2	88	2	83
3	4	10	4	40	4	17	4	32	4	23
4	5	47	5	87	5	56	5	76	5	66
5	6	84	7	33	6	95	7	20	6	07
6	8	20	8	80	8	34	8	64	8	49
7	9	57	10	26	9	73	10	08	9	90
8	10	94	11	73	11	12	11	52	11	31
9	12	31	13	20	12	61	12	96	12	73
10	13	67	14	96	13	90	14	40	14	14
20	27	35	29	33	27	80	28	79	28	28
30	41	02	43	99	41	71	43	19	42	43
40	54	69	58	65	55	61	57	58	56	57
50	68	37	73	31	69	51	71	98	70	71
60	82	04	87	98	83	41	86	38	44	85
70	95	71	102	84	97	31	100	77	98	99
80	109	39	117	30	111	22	115	17	113	14
90	123	06	131	96	125	12	129	56	127	28
100	136	73	146	63	139	02	143	96	141	42

A Table of the Sun's Right Aſcenſion.

Janua.		Febr.		March.		April.		May.		June.	
H.	M.	H.	M	H.	M.	H.	M.	H.	M.	A.	M.
19	35	21	43	23	28	1	21	3	14	5	20
19	38	21	46	23	32	1	25	3	18	5	24
19	43	21	50	23	36	1	29	3	22	5	28
19	47	21	54	23	39	1	32	3	26	5	32
19	51	21	58	23	43	1	36	3	30	5	36
19	56	22	02	23	47	1	40	3	34	5	40
20	00	22	06	23	50	1	43	3	38	5	44
20	05	22	10	23	54	1	47	3	42	5	49
20	09	22	14	23	58	1	51	3	46	5	53
20	13	22	17	0	01	1	54	3	50	5	57
20	17	22	21	0	05	1	58	3	54	6	01
20	21	22	25	0	08	2	02	3	58	6	05
20	25	22	29	0	12	2	06	4	02	6	09
20	30	22	33	0	16	2	09	4	06	6	14
20	34	22	36	0	19	2	13	4	10	6	18
20	38	22	40	0	23	2	17	4	14	6	22
20	42	22	44	0	27	2	21	4	18	6	26
20	46	22	48	0	30	2	24	4	22	6	30
20	50	22	51	0	34	2	28	4	26	6	34
20	54	22	55	0	38	2	32	4	30	6	38
20	59	22	59	0	41	2	36	4	34	6	42
21	03	23	03	0	45	2	40	4	48	6	47
21	37	23	06	0	48	2	44	4	43	6	51
21	11	23	10	0	52	2	47	4	47	6	55
21	15	23	14	0	56	2	51	4	51	6	59
21	19	23	17	0	59	2	55	4	55	7	03
21	23	23	21	1	03	2	59	4	59	7	07
21	27	23	25	1	06	3	03	5	03	7	11
21	31			1	10	3	07	5	07	7	15
21	35			1	14	3	10	5	11	7	20
21	39			1	17			5	15		

A Table of the Sun's Right Ascension.

Days.	July. H.	M.	August H.	M.	Sept. H.	M.	Octob. H.	M.	Nov. H.	M.	Dec. H.	M.
1	7	24	9	26	11	19	13	08	15	08	17	1
2	7	28	9	29	11	23	13	12	15	12	17	2
3	7	33	9	33	11	26	13	16	15	16	17	2
4	7	36	9	37	11	30	13	19	15	21	17	3
5	7	40	9	41	11	34	13	23	15	25	17	3
6	7	44	9	44	11	38	13	27	15	29	17	3
7	7	48	9	48	11	41	13	31	15	33	17	4
8	7	52	9	52	11	45	13	34	15	37	17	4
9	7	56	9	56	11	48	13	38	15	41	17	5
10	8	39	9	59	11	52	13	42	15	45	17	5
11	8	04	10	03	11	55	13	46	15	50	18	0
12	8	08	10	07	11	59	13	49	15	54	18	0
13	8	12	10	10	12	03	13	53	15	58	18	1
14	8	16	10	14	12	06	13	57	16	02	18	1
15	8	20	10	18	12	10	14	01	16	06	11	1
16	8	24	10	22	12	14	14	05	16	11	18	2
17	8	28	10	25	12	17	14	09	16	15	18	2
18	8	32	10	29	12	21	14	13	16	19	18	3
19	8	36	10	32	12	24	14	16	16	24	18	3
20	8	40	10	36	12	28	14	20	16	28	18	4
21	8	43	10	40	12	31	14	24	16	32	11	4
22	8	47	10	43	12	35	14	28	16	37	18	4
23	8	51	10	47	12	39	14	32	16	41	18	5
24	8	55	10	51	12	43	14	36	16	45	18	5
25	8	59	10	54	12	46	14	40	16	50	19	0
26	9	03	10	58	12	50	14	44	16	54	19	0
27	9	06	11	02	12	54	14	48	16	59	19	1
28	9	10	11	05	12	57	14	52	17	03	19	1
29	9	14	11	09	13	01	14	56	17	07	19	2
30	2	18	11	12	13	04	15	00	17	12	19	2
31	9	22	11	16			51	04			19	2

Th

The first Year after Leap-Year.

Sun's Declination 1681, 1685, 1689, 1693.

Jan.		Febr.		March.		April.		May.		June.	
South.		South.		South		North.		North.		North	
D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
21	41	13	42	3	20	8	40	18	7	23	11
21	31	13	22	2	56	9	02	18	22	23	15
21	21	13	02	2	32	9	23	18	37	23	18
21	10	12	41	2	09	9	45	18	51	23	21
20	58	12	21	1	45	10	06	19	06	23	24
20	47	11	59	1	21	10	27	19	19	23	26
20	34	11	38	0	59	10	48	19	33	23	27
20	22	11	17	0	34	11	09	19	46	23	29
20	09	10	56	0	10	11	30	19	59	23	30
19	56	10	34	Nor	13	11	50	20	11	23	30
19	42	10	12	0	37	12	11	20	23	23	30
19	28	9	50	1	01	12	31	20	35	23	30
19	14	9	28	1	24	12	50	20	46	23	29
18	59	9	06	1	48	13	10	20	57	23	27
18	44	8	43	2	11	13	30	21	08	23	26
18	29	8	21	2	35	13	49	21	18	23	24
18	13	7	58	2	38	14	03	21	28	23	21
17	57	7	36	3	22	14	27	21	38	23	28
17	41	7	13	3	45	14	45	21	47	23	15
17	24	6	50	4	08	15	03	21	56	23	11
17	07	6	27	4	31	15	21	22	04	23	07
16	50	6	04	4	54	15	39	22	12	23	03
16	32	5	40	5	17	15	57	22	20	22	58
16	14	5	17	5	40	16	14	22	27	22	53
15	56	4	54	6	13	16	31	22	34	22	47
15	38	4	30	6	26	16	48	22	41	22	41
15	20	4	07	6	49	17	04	22	47	22	34
15	00	3	43	7	11	17	21	22	53	22	27
14	41			7	33	17	37	22	58	22	20
14	22			7	56	17	52	23	03	22	12
14	02			8	18			23	07		

The

The Sun's Declination 1681, 1685, 1689, 16

Days.	July. North. D.	M.	August North. D.	M.	Sept. North. D.	M.	Octob. South. D.	M.	Nov. South. D.	M.	Dec Sout D.
1	22	4	15	6	4	17	7	21	17	43	23
2	21	56	14	48	3	54	7	54	17	59	23
3	21	47	14	30	3	31	8	6	18	15	23
4	21	38	14	11	3	8	8	29	18	31	23
5	21	28	13	52	2	45	8	51	18	46	23
6	21	18	13	33	2	21	9	13	19	1	23
7	21	8	13	14	1	58	9	35	19	16	23
1	20	58	12	54	1	35	9	56	19	30	23
9	20	47	12	35	1	11	10	19	19	44	23
10	20	35	12	15	0	48	10	40	19	57	23
11	20	24	11	55	0	24	11	2	20	10	23
12	20	12	11	35	0	01	11	23	20	23	23
13	19	59	11	14	Sou.	22	11	49	20	36	23
14	19	47	10	53	0	46	12	5	20	48	23
15	19	34	10	33	1	09	12	26	20	59	23
16	19	20	10	12	1	33	12	46	21	11	23
17	19	7	9	51	1	56	13	7	21	21	23
18	18	53	9	29	2	20	13	27	21	32	23
19	11	38	9	7	2	44	13	47	21	42	23
20	18	24	8	46	3	07	14	7	21	51	23
21	18	9	8	24	3	30	14	26	22	1	23
22	17	54	8	2	3	54	14	45	22	9	22
23	17	38	7	40	4	17	15	4	22	18	22
24	17	22	7	18	4	40	15	23	22	26	22
25	17	6	6	56	5	3	15	41	22	33	22
26	16	50	6	34	5	27	16	0	22	40	22
27	16	33	6	11	5	50	16	18	22	47	22
28	16	16	5	48	6	12	16	35	22	53	22
29	15	59	5	26	6	36	16	53	22	58	22
30	15	42	5	3	6	58	17	10	23	03	22
31	15	24	4	40			17	27			21

T

The second Year after Leap-Year.

Sun's Declination 1682, 1686, 1690, 1694

Jan.		Febr.		March.		April.		May.		June.	
South.		South.		South.		North.		North.		North	
D.	M.	D.	M.	D.	M	D.	M.	D.	M.	D.	M.
21	43	13	47	3	26	8	39	18	4	23	11
21	34	13	27	3	02	8	56	18	19	23	14
21	23	13	7	2	38	9	18	18	34	23	18
21	12	12	46	2	15	9	40	18	48	23	21
21	1	12	25	1	51	10	01	19	02	23	23
20	49	12	5	1	27	10	22	19	16	23	25
20	37	11	43	1	03	10	43	19	29	23	27
20	25	11	22	0	40	11	4	19	43	23	28
20	12	11	01	0	16	11	25	19	55	23	29
19	59	10	39	Nor.	4	11	45	20	8	23	30
19	49	10	17	0	31	12	6	20	20	23	30
19	32	9	55	0	55	12	26	20	32	23	30
19	18	9	33	1	19	12	46	20	44	23	29
19	3	9	11	1	42	13	5	20	55	23	28
18	48	8	49	2	05	13	25	21	05	23	26
18	33	8	26	2	29	13	44	21	16	23	24
18	17	8	4	2	53	14	3	21	26	23	22
18	1	7	41	3	16	14	22	21	36	23	19
17	45	7	18	3	39	14	41	21	45	23	16
17	28	6	55	4	03	14	59	21	54	23	12
17	11	6	32	4	26	15	17	21	2	23	8
16	54	6	9	4	49	15	25	21	10	23	4
16	37	5	46	5	12	15	35	22	18	22	59
16	19	5	23	5	35	16	10	22	26	22	54
16	1	4	59	5	58	16	27	22	33	22	48
15	42	4	36	6	21	16	44	22	39	22	42
15	24	4	12	6	43	17	0	22	45	22	36
15	5	3	49	7	5	17	17	22	51	22	29
14	46			7	28	17	33	22	57	22	22
14	27			7	50	17	48	23	2	22	14
14	7			8	12			23	6		

The second Year after Leap-Year.

The Sun's Declination 1682, 1686, 1690, 16

Days.	July. North. D.	M.	August North. D.	M.	Sept. North. D.	M.	October South. D.	M.	Nov. South. D.	M.	Dec South. D.
1	21	6	15	11	4	23	7	15	17	39	23
2	21	58	14	53	4	0	7	38	17	55	23
3	21	49	14	34	3	37	8	1	18	12	23
4	21	40	14	16	3	14	8	23	18	27	23
5	21	31	13	57	2	50	8	46	18	42	23
6	21	21	13	38	2	27	9	8	18	58	23
7	21	11	13	19	2	04	9	30	19	12	23
1	21	0	12	59	1	40	9	52	19	26	23
9	20	49	12	39	1	17	10	13	19	40	23
10	20	38	12	20	0	53	10	35	19	54	23
11	20	27	12	0	0	30	10	57	20	7	23
12	20	14	11	40	0	7	11	18	20	20	23
13	20	2	11	19	Sou.	17	11	39	20	33	23
14	19	50	10	58	0	40	12	0	20	45	23
15	19	37	10	38	1	04	12	21	20	57	23
16	19	23	10	17	1	27	12	41	21	8	23
17	19	10	9	56	1	51	13	2	21	19	23
18	18	56	9	34	2	14	13	22	21	29	23
19	11	42	9	13	2	38	13	42	21	39	23
20	18	27	8	51	3	01	14	2	21	49	23
21	18	12	8	29	3	25	14	21	21	58	23
22	17	57	8	8	3	48	14	41	22	7	23
23	17	42	7	46	4	11	15	0	22	16	22
24	17	26	7	24	4	34	15	18	22	24	22
25	17	10	7	01	4	58	15	37	22	31	22
26	16	54	6	39	5	21	15	55	22	38	22
27	16	37	6	17	5	44	16	13	22	45	22
28	16	21	5	54	6	7	16	31	22	51	22
29	16	03	5	31	6	30	17	39	22	57	22
30	15	46	5	8	6	53	17	6	23	2	22
31	15	28	4	46			17	23			21

The third Year after Leap-Year.

Sun's Declination 1683, 1687, 1691, 1695

Jan. South.		Febr. South.		March. South.		April North.		May. North.		June. North.	
D.	M.	D.	M.	D.	M	D.	M.	D.	M.	D.	M.
21	46	13	52	3	31	8	29	18	0	23	10
21	36	13	32	3	8	8	51	18	15	23	13
21	26	13	12	2	44	9	13	18	30	23	17
21	15	12	51	2	26	9	39	18	44	23	20
21	0	12	31	1	57	9	56	18	59	23	23
20	52	12	10	1	33	10	17	19	13	23	25
20	40	11	49	1	9	10	38	19	26	23	27
20	28	11	28	0	45	10	59	19	40	23	28
20	15	11	6	0	22	11	20	19	52	23	29
20	2	10	44	Nor.	02	11	40	20	5	23	30
19	49	10	23	0	26	12	1	20	17	23	30
19	35	10	1	0	49	12	21	20	29	23	30
19	21	9	39	1	13	12	41	20	41	23	29
19	7	9	17	1	36	13	0	20	52	23	28
18	52	8	54	2	00	13	20	21	03	23	27
18	36	8	32	2	23	13	40	21	13	23	25
18	21	8	9	2	47	13	59	21	24	23	22
18	5	7	46	3	10	14	18	21	33	23	20
17	49	7	24	3	34	14	36	21	43	23	17
17	32	7	01	3	57	14	55	21	52	23	13
17	15	6	38	4	20	15	13	22	0	23	9
16	58	6	15	4	43	15	31	22	8	23	5
16	41	5	52	5	06	15	48	22	16	23	0
16	23	5	28	5	29	16	6	22	24	22	55
16	5	5	5	5	52	16	23	22	31	22	50
15	47	4	42	6	15	16	40	22	38	22	44
15	28	4	18	6	37	16	56	22	44	22	37
15	10	3	55	7	0	17	13	22	50	22	31
14	50			7	23	17	29	22	55	22	24
14	31			7	45	17	44	23	0	22	8
14	12			8	07			23	5		

The third Year after Leap-Year.

The Sun's Declination 1683, 1687, 1691, 16

Days.	July. North. D.	M.	August North. D.	M.	Sept. North. D.	M.	October South. D.	M.	Nov. South. D.	M.	Dec. South. D.
1	22	8	15	15	4	28	7	10	17	35	23
2	22	0	14	57	4	5	7	33	17	52	23
3	21	51	14	39	3	42	7	55	18	8	23
4	21	43	14	20	3	19	8	18	18	23	23
5	21	33	14	01	2	56	8	40	18	39	23
6	21	23	13	43	2	33	9	2	18	54	23
7	21	13	13	23	2	9	9	24	19	9	23
8	21	3	13	4	1	46	9	47	19	23	23
9	20	52	12	44	1	23	10	8	19	37	23
10	20	41	12	24	0	59	10	30	19	51	23
11	20	29	12	5	0	36	10	51	20	4	23
12	20	18	11	44	0	12	11	13	20	17	23
13	20	5	11	24	Sou.	11	11	34	20	30	23
14	19	53	11	3	0	35	11	55	20	42	23
15	19	40	10	43	0	58	12	16	20	54	23
16	19	17	10	22	1	22	12	36	21	5	23
17	19	13	10	01	1	45	12	57	21	16	23
18	19	0	9	40	2	9	13	17	21	27	23
19	18	45	9	18	2	32	13	37	21	37	23
20	18	31	8	56	2	55	13	57	21	47	23
21	18	16	8	35	3	19	14	17	21	56	23
22	18	1	8	13	3	42	14	36	22	5	22
23	17	46	7	51	4	6	14	55	22	14	22
24	17	30	7	29	4	29	15	14	22	22	22
25	17	14	7	7	4	52	15	32	22	29	22
26	16	58	6	44	5	15	15	51	22	37	22
27	16	42	6	22	5	38	16	5	22	43	22
28	16	25	5	59	6	2	16	27	22	50	22
29	16	8	5	37	6	24	16	44	22	56	22
30	15	50	5	14	6	47	17	2	23	1	22
31	15	33	4	51			17	19			21

e Sun's Declination 1684, 1688, 1692, 1696.

Jan. South.		Febr. South.		March. South.		April. North.		May. North.		June. North.	
D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
21	48	13	57	3	13	8	46	18	0	23	12
21	38	13	37	2	50	9	7	18	27	23	16
21	28	13	17	2	26	9	29	18	41	23	19
21	18	12	56	2	2	9	51	18	55	23	22
21	7	12	36	1	39	10	12	19	9	23	24
20	55	12	15	1	15	10	33	19	23	23	26
20	43	11	54	0	51	10	54	19	36	23	28
20	31	11	32	0	28	11	15	19	49	23	29
20	19	11	11	0	4	11	35	20	2	23	30
20	5	10	50	Nor.	20	11	56	20	14	23	30
19	52	10	28	0	43	12	16	20	27	23	30
19	38	10	6	1	7	12	36	20	38	23	29
19	24	9	44	1	30	12	56	20	49	23	28
19	10	9	22	1	54	13	15	21	0	23	27
18	55	9	00	2	18	13	35	21	11	23	25
18	40	8	37	2	41	13	54	21	21	23	23
18	24	8	15	3	05	14	13	21	31	23	20
18	9	7	52	3	28	14	32	21	40	23	17
17	53	7	29	3	51	14	50	21	49	23	14
17	36	7	7	4	14	15	8	21	58	23	10
17	20	6	41	4	38	15	26	22	7	23	6
17	2	6	21	5	1	15	44	22	14	23	1
16	45	5	57	5	24	16	2	22	22	22	56
16	27	5	34	5	47	16	19	22	29	22	51
16	10	5	11	6	9	16	36	22	36	22	45
15	51	4	47	6	32	16	52	22	43	22	29
15	33	4	24	6	55	17	9	22	49	22	32
15	14	4	1	7	17	17	25	22	54	22	24
14	55	3	37	7	39	17	41	22	59	22	18
14	36			8	02	17	56	23	04	22	10
14	16			8	24			23	9		

The Leap-Year.

The Sun's Declination 1684, 1688, 1692, 169

Days.	July. North. D.	M.	Auguſt North. D.	M.	Sept. North. D.	M.	Octob. South. D.	M.	Nov. South. D.	M.	Dec Sout D.
1	22	2	15	1	4	11	7	27	17	48	23
2	21	54	14	43	3	48	7	50	18	4	23
3	21	45	14	21	3	25	8	12	18	20	23
4	21	35	14	6	3	02	8	35	18	35	23
5	21	26	13	47	2	38	8	57	18	50	23
6	21	16	13	28	2	15	9	18	19	5	23
7	21	05	13	9	1	52	9	41	19	20	23
8	20	55	12	49	1	28	10	3	19	34	23
9	20	44	12	29	1	5	10	25	19	47	23
10	20	32	12	10	0	41	10	46	20	01	23
11	20	21	11	49	0	18	11	8	20	14	23
12	20	08	11	29	0	6	11	29	20	27	23
13	19	56	11	8	Sou.	29	11	50	20	39	23
14	19	43	10	48	0	53	12	11	20	51	23
15	19	30	10	27	1	16	12	32	21	2	23
16	19	17	10	6	1	40	12	52	21	13	23
17	19	03	9	45	2	03	13	12	21	24	23
18	18	49	9	23	2	27	13	32	21	35	23
19	18	34	9	2	2	50	13	52	21	44	23
20	18	20	8	40	3	13	14	12	21	54	23
21	18	05	8	18	3	37	14	31	22	3	23
22	17	50	7	56	4	0	14	50	22	12	22
23	17	34	7	34	4	23	15	9	22	20	22
24	17	18	7	12	4	47	15	28	22	28	22
25	17	02	6	50	5	10	15	47	22	35	22
26	16	46	6	27	5	33	16	5	22	42	22
27	16	29	6	5	5	56	16	23	22	48	22
28	16	12	5	42	6	19	16	40	22	54	22
29	15	55	5	20	6	42	16	58	23	0	22
30	15	37	4	57	7	05	17	15	23	5	22
31	15	20	4	34			17	31			21

e *Use of these Tables of the Sun's Declination.*

Ook the Year on the Head of the Table, and the Month under it; and the Day down along the Left d Colum, and right against the Day in the Column ropriated to the Month, you have the Sun's Declina- for that Day at Noon under the Meridian of *London*.

EXAMPLE.

To find the Sun's Declination the 25th of *July* at Noon, 1684.

Turn over the Table till you find the Year 1684, then k downwards under the Month *July*, till against the h day, and there you'll find 17 deg. 2 min. Declinat. rth.

But if you be to the Eastward or Westward of the ridian of *London*, you must make an allowance in the 's Declination, according to the following little Table

A Table to Reduce the Sun's Declinat to any other Meridian.

Daily Diff. of Declinat.		m. 0	m. 3	m. 6	m. 9	m. 12	m. 15	m. 18	m. 21	m.
		m.	m.	m.	m.	m.	m.	m.	m.	m
	15	0	0	0	0	0	0	1	1	
	30	0	0	0	0	1	1	1	2	
	45	0	0	0	1	1	2	2	3	
Degrees	60	0	0	1	1	2	2	3	3	
of Long.	75	0	0	1	2	2	3	4	4	
either	90	0	0	1	2	3	4	4	5	
East or	105	0	1	2	2	3	4	5	6	
West.	120	0	1	2	3	4	5	6	7	
	135	0	1	2	3	4	5	7	8	
	150	0	1	2	3	5	6	8	9	1
	165	0	1	2	4	5	6	8	10	1
	180	0	1	3	4	6	7	9	11	1

If the Difference of Longitude be Westerly, and Declination increasing, the number found in this Table must be added to the Declination found; but if Declination be decreasing, it must be substracted th from; and the contrary.

Admit the 25th of *June*, 1684, you desire to k the Sun's Declination at 105 degr. Longitude East *London*.

The Declination for the 25th of *July* in the Meri

London is 17 deg. 02 min. and the daily difference
hat time is 16 min. Which 16 min, looked in the
d of the Table, cannot be found but under the near-
hereto, *viz.* 15 min, and right againſt 105 deg. you'll
4 min. which muſt be added to 17 deg. 0 min.
the ſum 17 deg. 06 min. is the true Declination
e at Noon; but if it had been 105 deg. Weſt Long.
Declination would have been but 16 deg. 58 min.

A Table of Amplitudes.

Decl. Suns	4		6		8		10		12		14		16
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.
1	1	0	1	0	1	0	1	1	1	1	1	1	1
2	2	0	2	0	2	1	2	2	2	2	2	2	2
3	3	0	3	1	3	1	3	2	3	3	3	4	3
4	4	1	4	2	4	4	4	3	4	6	4	9	4
5	5	1	5	2	5	4	5	4	5	7	5	10	5
6	6	1	6	2	6	4	6	5	6	8	6	13	6
7	7	1	7	3	7	5	7	6	7	9	7	13	7
8	8	1	8	3	8	5	8	7	8	9	8	13	8
9	9	1	9	3	9	5	9	7	9	10	9	14	9
10	10	1	10	3	10	6	10	8	10	12	10	18	10
11	11	1	11	4	11	6	11	9	11	13	11	19	11
12	12	1	12	4	12	7	12	11	12	16	12	22	12
13	13	2	13	4	13	7	13	12	13	18	13	26	13
14	14	2	14	5	14	9	14	13	14	19	14	26	14
15	15	2	15	5	15	9	15	14	15	20	15	28	15
16	16	2	16	5	16	10	16	15	16	22	16	30	16
17	17	3	17	6	17	10	17	16	17	24	17	32	17
18	18	3	18	6	18	11	18	17	18	25	18	35	18
19	19	3	19	6	19	12	19	18	19	27	19	37	19
20	20	3	20	7	20	12	20	19	20	28	20	38	20
21	21	1	21	7	21	13	21	20	21	29	21	40	21
22	22	4	22	8	22	13	22	21	22	31	22	42	22
23	23	4	23	9	23	15	23	22	23	33	23	44	23
23 1/2	23	4	23	9	23	15	23	53	24	05	24	16	24
24	24	5	24	9	24	16	24	24	24	36	24	48	25
25	25	5	25	10	25	17	25	25	25	37	25	50	26
26	26	15	26	10	26	18	26	26	26	39	26	53	27
27	27	16	27	11	27	19	27	27	27	40	27	55	28
28	28	16	28	11	28	20	28	28	28	42	28	57	29
29	29	16	29	12	29	20	29	29	29	45	30	00	30
30	30	17	30	12	30	21	30	31	30	47	31	03	31

A Table of Amplitudes.

18		20		21		22		23		24		25	
D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	3	1	4	1	4	1	5	1	5	1	6	1	6
2	5	2	7	2	7	2	8	2	9	2	10	2	11
3	8	3	10	3	11	3	13	3	14	3	15	3	17
4	14	4	17	4	19	4	21	4	23	4	25	4	27
5	16	5	19	5	21	5	23	5	26	5	28	5	21
6	19	6	24	6	26	6	29	6	32	6	35	6	38
7	21	7	26	7	29	7	32	7	36	7	40	7	44
8	24	8	31	8	34	8	38	8	42	8	46	8	50
9	26	9	35	9	39	9	43	9	47	9	51	9	56
10	31	10	38	10	43	10	48	10	53	10	58	11	02
11	31	11	39	11	43	11	48	11	53	12	00	12	08
12	38	12	47	12	52	12	57	13	03	13	09	13	16
13	41	13	51	13	57	14	03	14	09	14	15	14	22
14	45	14	55	15	01	14	08	15	15	15	22	15	29
15	48	16	00	16	07	16	14	16	21	16	28	16	35
16	52	17	03	17	10	17	17	17	25	17	33	17	42
17	54	18	7	18	15	18	21	18	31	18	40	18	49
18	58	19	12	19	20	19	29	19	38	19	47	19	56
20	00	20	16	20	24	20	33	20	43	20	53	21	03
21	04	21	21	21	30	21	39	21	49	21	59	22	10
22	10	22	38	22	37	22	46	22	56	23	06	23	17
23	11	23	30	23	40	23	50	24	01	24	13	24	25
24	13	24	34	24	46	24	56	25	8	25	21	25	35
24	48	25	06	25	18	25	29	25	41	25	54	26	08
25	22	25	38	25	50	26	01	25	13	26	27	26	40
26	24	26	43	26	55	27	07	27	19	27	34	27	27
27	28	27	48	28	00	28	14	28	26	28	43	28	55
28	33	28	53	29	6	29	20	29	32	29	50	30	04
29	35	29	58	30	12	30	27	30	40	30	57	31	12
30	39	31	03	31	18	31	34	31	48	32	04	32	20
31	45	32	8	32	24	32	40	32	56	33	12	33	29

A Table of Amplitudes.

Sun's dec.	26		27		28		29		30		31		3
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.
1	1	7	1	7	1	8	1	8	1	09	1	10	1
2	2	12	2	13	2	15	2	16	2	17	2	19	2
3	3	19	3	21	3	22	3	24	3	26	3	29	3
4	4	29	4	31	4	34	4	36	4	39	4	41	4
5	5	33	5	36	5	39	5	43	5	46	5	50	5
6	6	41	6	45	6	48	6	52	6	57	7	01	7
7	7	48	7	52	7	56	8	00	8	05	8	10	8
8	8	55	9	00	9	05	9	10	9	15	9	21	9
9	10	01	10	06	10	12	10	18	10	24	10	31	10
10	11	09	11	15	11	21	11	27	11	34	11	42	11
11	12	16	12	23	12	30	12	37	12	44	12	51	12
12	13	23	13	30	13	37	13	44	14	53	14	02	14
13	14	29	14	38	14	45	14	53	15	02	15	11	15
14	15	37	15	46	15	55	16	04	16	13	16	24	16
15	16	44	16	53	17	03	17	13	17	23	17	34	17
16	17	51	18	00	18	10	18	21	18	33	18	45	18
17	18	59	19	10	19	21	19	32	19	44	19	57	20
18	20	07	20	18	20	29	20	41	20	54	21	08	21
19	21	14	21	26	21	38	21	51	22	05	22	19	22
20	22	22	22	34	22	47	23	01	23	16	23	31	23
21	23	28	23	41	23	55	24	10	24	25	24	41	25
22	24	38	24	52	25	07	25	22	25	38	25	55	26
23	25	49	26	02	26	18	26	33	26	49	27	07	27
23½	26	23	26	38	26	53	27	09	27	25	27	37	28
24	26	56	27	12	27	28	27	44	28	01	28	20	28
25	28	04	28	21	28	39	28	57	29	13	29	32	29
26	29	15	29	33	29	50	30	07	30	25	30	46	31
27	30	22	30	41	31	00	31	18	31	37	31	58	32
28	31	31	31	50	32	09	32	29	32	50	33	13	33
29	32	40	33	01	33	21	33	42	34	03	34	27	34
30	33	49	34	10	34	22	34	44	35	16	35	41	36

A Table of Amplitudes.

33		34		35		36		37		38		39	
D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	12	1	12	1	13	1	14	1	15	1	16	1	17
2	23	2	25	2	26	2	28	2	30	2	32	2	34
3	34	3	37	3	40	3	43	3	45	3	48	3	5
4	48	4	52	4	55	4	57	5	00	5	84	5	08
5	58	6	02	6	06	6	11	6	16	6	21	6	26
7	11	7	15	7	20	7	25	7	31	7	37	7	44
8	20	8	25	8	32	8	40	8	47	8	54	9	01
9	33	9	40	9	47	9	54	10	02	10	10	10	19
10	45	10	53	11	01	11	09	11	13	11	27	11	37
11	58	12	06	12	17	12	24	12	33	12	43	12	54
13	08	13	17	13	27	13	38	13	49	14	01	14	13
14	12	14	32	14	42	4	53	15	05	15	18	15	31
15	33	15	44	15	56	16	04	16	22	16	35	16	49
16	46	16	58	17	11	17	24	17	38	17	53	18	08
17	59	18	11	18	25	18	40	8	55	19	10	19	29
19	11	19	25	19	40	19	55	20	11	20	28	20	40
20	24	20	39	20	55	21	11	21	28	21	46	22	00
21	37	21	53	22	10	22	27	22	48	22	05	23	26
22	50	23	07	23	25	23	44	24	03	24	24	24	46
24	04	24	22	24	41	25	00	25	21	25	43	26	06
25	19	25	37	25	57	26	18	26	39	27	03	27	27
26	32	26	52	27	13	27	35	27	58	28	23	28	49
27	46	28	07	28	29	28	53	29	17	29	43	30	11
28	24	28	45	29	07	29	32	29	57	30	25	30	53
29	01	29	23	29	46	30	11	30	37	31	06	31	35
30	16	30	39	31	04	31	30	31	57	32	27	32	58
31	31	31	55	32	21	32	48	33	17	33	48	34	21
32	47	33	12	33	39	34	08	34	17	34	57	35	38
34	03	34	30	34	58	35	28	36	00	36	33	37	06
35	19	35	47	36	18	36	49	37	23	38	01	38	38
36	36	37	05	37	38	38	10	38	46	39	26	40	03

A Table of Amplitudes.

Sun's Dec.	40		41		42		43		44		45		46	
	d.	m.	d.	m.	d.	m.	d.	m.	d.	m.	d.	m.	d.	m.
1	1	18	1	19	1	20	1	21	1	23	1	25	1	27
2	2	37	2	37	2	42	2	44	2	47	2	50	2	54
3	3	55	3	56	4	02	4	06	4	10	4	15	4	20
4	5	13	5	17	5	22	5	28	5	34	5	40	5	47
5	6	32	6	38	6	44	6	51	6	58	7	05	7	13
6	7	51	7	58	8	06	8	13	8	21	8	30	8	39
7	9	09	9	17	9	26	9	35	9	45	9	55	10	06
8	10	28	10	37	10	47	10	58	10	09	10	21	11	33
9	11	47	11	57	12	09	12	21	12	33	12	47	13	01
10	12	06	12	18	13	31	12	44	12	58	13	13	14	29
11	14	26	14	38	14	52	15	07	15	22	15	39	15	57
12	15	45	16	00	16	15	16	31	16	48	17	06	16	25
13	17	05	17	20	17	37	17	55	18	14	18	33	17	53
14	18	25	18	42	19	00	19	19	19	39	19	00	20	22
15	9	45	19	03	19	23	19	44	19	05	19	82	21	52
16	21	05	21	25	21	46	22	08	22	32	22	56	23	22
17	22	20	22	47	23	10	23	34	23	59	24	25	24	52
18	23	48	24	10	24	34	25	00	25	26	25	54	26	23
19	25	09	25	33	25	59	26	26	26	54	27	24	27	55
20	26	31	26	57	27	24	27	53	28	23	28	56	30	29
21	27	53	28	20	28	49	29	20	29	54	30	27	31	04
22	29	17	29	45	30	16	30	49	31	24	31	59	32	40
23	30	40	31	10	31	43	32	17	32	54	33	32	34	17
24	31	22	31	55	32	30	33	05	33	38	34	20	35	05
25	33	29	34	40	33	16	33	53	34	30	35	07	35	54
26	34	54	35	03	34	43	34	23	36	03	36	42	37	23
27	36	20	37	03	37	46	36	57	37	38	38	19	39	01
28	37	48	37	35	39	20	38	30	38	13	39	37	40	19
29	39	16	40	04	40	52	40	06	40	50	41	36	42	17
30	40	45	41	36	42	27	43	18	44	05	45	00	45	56

A Table of Amplitudes.

Sun's Dec.	47		48		49		50		51		52		53	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	1	27	1	29	1	31	1	33	1	35	1	37	1	39
2	2	56	2	59	3	03	3	07	3	11	3	15	3	19
3	4	25	4	29	34	34	4	40	4	46	4	52	4	59
4	5	52	5	59	6	06	6	14	6	22	6	30	6	39
5	7	20	7	29	7	38	7	48	7	58	8	09	8	20
6	8	49	8	59	9	09	9	21	9	33	9	46	10	00
7	10	18	10	31	10	43	10	56	11	10	11	25	11	41
8	11	46	12	00	12	15	12	31	12	47	13	04	13	22
9	13	16	13	31	13	47	14	05	14	24	14	44	15	04
10	14	44	15	02	15	21	15	40	16	01	16	23	16	46
11	16	15	16	34	16	54	17	19	17	39	18	03	18	29
12	17	45	18	06	18	28	18	52	19	17	19	41	20	11
13	19	35	19	49	19	15	19	37	20	57	21	19	21	52
14	20	46	21	12	21	28	22	06	22	36	23	06	23	42
15	22	19	22	45	23	14	23	45	24	17	24	52	25	28
16	23	50	24	20	24	51	25	24	25	58	26	35	27	15
17	25	22	25	54	26	27	27	03	27	40	28	21	29	04
18	26	50	27	30	28	06	28	42	29	24	30	08	30	54
19	28	30	29	06	29	45	30	20	31	09	31	55	32	44
20	30	44	31	25	32	09	32	55	33	45	34	38	35	35
21	31	41	32	13	33	06	33	53	34	42	35	36	36	33
22	33	19	34	05	34	49	35	39	39	12	37	29	38	30
23	34	57	35	44	36	33	37	26	38	23	39	23	40	29
23	35	51	36	39	37	21	38	21	39	25	40	30	41	39

A Table of Amplitudes.

Sun's Dec.	54 D.	54 M.	55 D.	55 M.	56 D.	56 M.	57 D.	57 M.	58 D.	58 M.	59 D.	59 M.	60 D.	60 M.
1	1	42	1	45	1	47	1	50	1	53	1	56	2	0
2	3	24	3	29	2	35	3	41	3	47	3	53	4	0
3	5	06	5	14	5	22	5	31	5	40	5	50	6	1
4	6	49	6	59	7	10	7	22	7	34	7	47	8	1
5	8	31	8	44	8	57	9	12	9	28	9	45	10	2
6	10	14	10	30	10	46	11	03	11	22	11	42	13	4
7	11	58	12	16	12	35	12	56	13	18	13	41	14	6
8	13	41	14	03	14	24	14	48	15	14	15	40	16	10
9	15	26	15	50	16	15	16	42	17	10	17	40	18	14
10	17	11	17	37	18	06	18	36	19	08	19	42	20	19
11	18	56	19	29	19	56	20	29	21	06	21	46	22	26
12	20	41	21	15	21	50	22	27	23	06	23	48	22	34
13	22	27	23	01	23	44	24	28	25	06	25	50	26	42
14	24	18	24	47	25	38	26	22	27	10	28	00	28	56
15	26	07	26	45	27	35	28	22	29	14	30	11	31	10
16	27	58	28	43	29	32	30	24	31	20	32	21	33	27
17	29	50	30	39	31	32	32	28	33	29	34	36	35	47
18	31	43	32	38	33	33	34	34	35	40	36	52	38	10
19	33	31	34	35	35	36	36	42	37	02	39	12	40	37
20	36	27	36	39	37	43	38	54	40	12	41	36	43	06
21	37	34	38	40	39	51	41	11	42	33	44	05	46	40
22	39	26	40	47	42	05	43	27	44	59	46	40	48	31
23	41	40	42	56	43	45	45	50	47	30	49	20	51	21
23½	42	50	43	23	44	55	47	01	48	45	50	49	52	17

A Table of Refractions.

Refra.	
M.	Se.
30	00
25	15
18	30
14	00
11	00
9	30
7	30
6	30
5	45
5	00
4	30
4	15
4	00
3	45
3	30
3	15
3	00
2	45
2	30
2	15
2	00
2	00
1	45
1	45
1	30
1	30
1	30
1	15
1	15
1	15
1	00

The Use of this Table of Refractions.

Look the Altitude of the Sun or Star in the first Column, under A. and right against it in the other Column you have the Minutes and Seconds refracted, which you must substract from the Alt. found by Observation.

North Latitude.

Deg.	Lat.	5	10	15	20	25	30	35	40
Sun's	Setti.	H.M	H.M	H.M	H.M	H.M	H.M	H.M	H.M
December. 11	11	5 51	5 42	5 33	5 24	5 13	5 2	4 49	4 34
17	De. 5	5 51	5 42	5 33	5 24	5 13	5 3	4 50	4 35
23	29	5 52	5 43	5 33	5 25	5 14	5 4	4 51	4 36
28	November. 23	5 52	5 43	5 34	5 25	5 16	5 6	4 53	4 41
January. 3	17	5 53	5 44	5 35	5 27	5 18	5 8	4 56	4 44
9	11	5 53	5 45	5 37	5 29	5 21	5 11	5 00	4 48
15	November. 6	5 54	5 46	5 39	5 31	5 23	5 15	5 04	4 54
21	31	5 54	5 48	5 41	5 33	5 26	5 19	5 10	5 00
27	October. 25	5 55	5 49	5 43	5 36	5 30	5 23	5 15	5 06
February. 2	19	5 56	5 50	5 45	5 39	5 34	5 28	5 21	5 12
8	13	5 56	5 52	5 47	5 43	5 38	5 33	5 28	5 21
14	October. 7	5 57	5 53	5 49	5 45	5 42	5 38	5 34	5 28
20	31	5 58	5 55	5 52	5 49	5 47	5 44	5 41	5 36
26	September. 25	5 58	5 57	5 55	5 52	5 51	5 49	5 47	5 42
March. 4	18	5 59	5 58	5 57	5 56	5 55	5 54	5 53	5 51
10	12	6 0	6 0	6 0	6 0	6 0	6 0	6 0	6 0
16	September. 6	6 1	6 2	6 3	6 4	6 5	6 6	6 7	6 8
22	31	6 2	6 3	6 5	6 7	6 9	6 11	6 13	6 16
28	August. 25	6 2	6 5	6 8	6 11	6 13	6 16	6 19	6 23
April. 3	19	6 3	6 7	6 11	6 15	6 18	6 22	6 26	6 31
9	13	6 4	6 8	6 13	6 17	6 22	6 27	6 32	6 38
15	August. 6	6 4	6 10	6 15	6 21	6 26	6 31	6 39	6 47
22	31	6 5	6 11	6 17	6 24	6 30	6 37	6 45	6 55
28	July. 25	6 6	6 12	6 19	6 27	6 34	6 41	6 50	7
May. 5	19	6 6	6 14	6 21	6 29	6 37	6 45	6 56	7
10	12	6 7	6 15	6 23	6 31	6 39	6 49	7 0	7 11
17	July. 6	6 7	6 16	6 25	6 33	6 42	6 52	7 4	7 15
23	30	6 8	6 17	6 26	6 35	6 44	6 54	7 7	7 20
29	June. 23	6 8	6 17	6 27	6 35	6 46	6 56	7 9	7 22
June. 4	17	6 9	6 18	6 27	6 36	6 47	6 57	7 10	7 23
11	11	6 9	6 18	6 27	6 36	6 47	6 58	7 11	7 24
Sums	rifin	H.M	H.M	H.M	H.M	H.M	H.M	H.M	H.
Deg.	Lat.	Lat.	10	15	20	25	30	35	

South Latitude.

A Table of the Sun's Rising and Setting.

North Latitude.

47	50	52	54	56	58	60	d.	L.
h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	S.	R
4 09	3 55	3 45	3 33	3 20	3 4	2 44	11	11
4 10	3 56	3 46	3 34	3 21	3 5	2 46	5	17
4 12	3 59	3 49	3 37	3 24	3 9	2 51	29	23
4 16	4 03	3 53	3 43	3 30	3 16	2 59	23	30
4 21	3 09	4 00	3 50	3 38	3 25	3 09	17	6
4 27	4 16	4 08	3 58	3 48	3 26	3 22	10	12
4 34	4 24	4 19	4 08	3 59	3 48	3 35	4	19
4 42	3 33	4 26	4 19	4 11	4 01	3 50	28	25
4 54	4 43	4 37	4 30	4 23	4 15	4 05	22	31
5 00	4 53	4 48	4 43	4 36	4 25	4 21	15	6
5 10	5 04	5 00	4 55	4 50	4 44	4 37	9	13
5 19	5 15	5 11	5 08	5 04	4 59	4 54	3	19
5 29	5 26	5 23	5 21	5 18	5 14	5 16	28	25
5 40	5 37	5 36	5 34	5 33	5 29	5 27	22	31
5 50	5 49	5 48	5 47	5 46	5 49	5 43	26	6
6 00	6 00	6 00	6 00	6 00	6 00	6 00	10	12
6 10	6 11	6 12	6 13	6 14	6 15	6 17	4	18
6 20	6 23	6 24	6 26	6 28	6 31	6 33	26	25
6 34	6 31	6 37	6 39	6 42	6 46	6 50	20	30
6 41	6 49	6 49	6 52	6 56	7 01	7 06	14	27
6 50	6 56	7 00	7 05	7 10	7 16	7 23	8	23
7 00	7 07	7 12	7 17	7 24	7 31	7 39	2	19
7 09	7 17	7 23	7 30	7 37	7 45	7 55	27	15
7 14	7 27	7 34	7 41	7 49	7 59	8 10	21	31
7 26	7 36	7 41	7 52	8 01	8 12	8 25	15	6
7 33	7 41	7 52	8 2	8 12	8 24	8 38	9	11
7 39	7 51	8 00	8 10	8 22	8 35	8 51	3	17
7 41	7 57	8 07	8 17	8 30	8 44	9 01	28	23
7 48	8 01	8 11	8 23	8 36	8 51	9 09	23	29
7 50	8 24	8 14	8 26	8 39	8 55	9 14	17	5
7 51	8 05	8 15	8 27	8 40	8 56	9 16	11	11
h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	S.	S.
47	54	52	54	56	58	60	d.	L.

South Latitude.

PROPOSITIONS OF THE Calendar.

What a Year and Month is; also the Prime, Epact and Dominical Letter.

A Common Year is 365¼ Days: A Leap Year is 366 Days.

A Month is either Solar, Lunar, or Civile.

The Solar Month is the ſpace of time that the Sun is in paſſing a Sign, that is the one twelfth part of the Ecliptick, or 30 degrees, which is about 30 days.

The

The Civile Month is a ſpace of time more or leſs, according to the pleaſure of the Magiſtrate, or the Civil Power, and are in our Calender according to this old Rhime,

Thirty Days hath September,
April, June, *and* November:
All the reſt have thirty one,
Save February *alone,*

Which hath but 28 in Common Years, and 29 in the Leap Year.

The Lunar Month is either Periodical, or Synodical.

The Periodical Month is 27 days, 7 hours, 43 minutes, being the ſpace of time in which the Moon paſſing from one point of the Zodiack through the twelve Signs, returns to the ſame again.

The Synodical Month is about 29 days and a half, the ſpace of time between one Conjunction of the Sun and Moon, and another.

The Prime, or Golden Number

Is a Revolution of 19 of our Civil Years, at the end of which time all the Aſpects of the Sun and Moon fall on the ſame days of the Months they did nineteen years before.

The Epact

Is a number multiplex of 11 days, which the common Solar Year doth exceed the Lunar by, and is never to exceed 30, becauſe the Moon's Age is never above 30.

The Dominical Letter

Is always one of theſe ſeven, A, B, C, D, E, F, G; and doth ſhew Sunday in the Calendar all the year round.

1. *To find the Biſſextile or Leap Year, or what Year after Leap-Year, any Year of the Lord propounded is.*

Divide the Year of the Lord by 4, and if nothing remain, that very Year is Leap-Year; but if any thing remain, that will ſhew what year after Leap-Year it is, and the Quotient gives the number of Leap-Years that have been ſince the Birth of *Chriſt*.

The Year 1685, what year after Leap-Year is it? The Quotient, 421, ſhews there have been 421 Leap-Years, and that the year 1685 is the firſt after Leap-Year.

2. *To*

2. *To find the Prime, or Golden Number.*

Add 1 to the Year of the Lord, and divide by 19, the remainder is the number sought, and the Quotient sheweth how many Revolutions of this number hath passed since the Birth of Christ.

Admit the Prime for the year 1683 were required.

1

19) 1684(88
152

164
152

12

The Prime is 12: and there will have been 88 Revolutions.

3. *To find the Epact.*

Multiply the Prime by 11, and divide the Product by 30, and the Remainder is the Epact.

Admit

Admit the Epact for the year 1703 be required.

1703
1

19) 1704 (89
152

184
171

Remaind. 13 The Prime.
11

13
13

30) 143 (4

23 The Epact.

4. *To find the Age of the Moon.*

Add to the day of the Month the Epact, and so many days more as are months from *March* to the Month you are in, including both months, and if that sum be under 30, that is the age; but if it exceed 30, take away 30, and the over-plus is the Moon's Age.

This

This is when the Month hath 31 days; but if the Month has but 30 days, you must take away only 29.

The fifth of *December*, 1680 I desire to know the Moon's Age.

1680
1

19) 1681 (88
16

9 The Prime.
11

30) 99 (3

9 Epact.
10 Number of Mon.
5 Days.

24 The Moon's Age.

5. *To find the Time of the Moon's Southing.*

Multiply the Moon's Age by 4, dividing the Product by 5, the Quotient gives the hours, and the Remainder multiplied by 12, the minutes over. But if she be above 15 days old, cast away 15, and take the Remainder to work with.

The

The time of the Moon's Southing is required
ober, 17, 1684.

1684
1

19) 1685 (88
16

13 The Prime.
11

13
13

30) 143 (4

23 The Epact.
8 Months.
17 *Days.*

48
30

18 Overplus.
15

3 Rem.
4

5) 12 (2 h. 24 min.
2
12
24

So that the time of Southing is twenty fo minutes after four of the clock.

The reaſon why you multiply by 4, and d vide by 5, is becauſe the Moon culminates 4 of an hour every night later than t night before.

Note, that between the New and the F the Moon comes to the South in the Evenin but after the Full, in the Morning.

To find the Time of High-Water.

Look the Moon's Age in the firſt column this little Table, and the number right agai it in the ſecond, being added to the hour High Water on the Change-day, the ſum the exact time of High-Water at the place a time propoſed.

Admit the Time of High-Water at *Lond Bridge* be required for *June* 25, 1682, I find the former direction the Moon's Age for propoſed time to be which look in this ſmall Table, under it's Title, Moo Age, right againſt it in the other column is to which I add 3 hours, becauſ S. W. Moon, or at three of the clock it's fo to be High Water here on the Change, or F and the ſum is the true time of H Water, *June* 25, 1682, the time propoſed.

The Tyde Table.

Moon's Age.	Tyde.
Days.	H. M.
1 —— 16	00 43
2 —— 17	01 20
3 —— 18	01 52
4 —— 19	02 22
5 —— 20	02 52
6 —— 21	03 26
7 —— 22	04 07
8 —— 23	04 55
9 —— 24	05 50
10 —— 25	06 53
11 —— 26	07 59
12 —— 17	09 04
13 —— 28	10 08
14 —— 29	11 05
15 —— 30	12 00

The Moon being 11 days old, till what the clock ſhall it flow at *Fluſhing*, where a N by E. and S. by W. Moon makes a Full S on the Change-day?

The 11 days looked in the Table gives 7 59 min. to which 0 h. 45 min. the time att buted to the N. by E. Point being added, t ſum 8 h. 44 min. is the true time of High-W ter at *Fluſhing*, always when the Moon is days old.

7. *To find the Dominical, or Sunday-Letter.*

To the year add it's fourth part and 4, di ding the ſum by 7, the remainder of this viſion taken from 7, and the reſt ſhews Dominical Letter, that is, if 7 remain *G* is Letter: if 1, *A*: 2, *B*: 3, *C*, &c.

In the Leap-Year there are two Lett uſed: the one found by this Rule ſerves fr S. *Matthias* to the laſt of *December*: but Letter preceding is uſed from the firſt of J to S. *Matthias* day.

Ad

dmit the Dominical Letter be required for year 1680.

```
4 ) 1680
     420
       4      7
-------------
7 ) 2104
     300        4
                3
```

The remaining 4 after the division by 7, ng taken from 7, leaves 3, which gives G the Sunday Letter, but considering it's ap-Year, this will serve but from St. *thias* day: and from *Jan.* 1, till S. *Mat-s*, *D* must be the Letter.

Note that the Epact changeth always the t of *March*; but the Dominical Letter and me the first of *Jan.*

To find on what day of the Week the first of March *in any year proposed shall fall.*

To the year add it's fourth part and 2, di-ing the sum by 7, the remainder of this ision gives the number of the day of the ek: as if 1 remains, it's Sunday: if 2, Mon-y, *&c.*

EXAMPLE.

If I would know what day of the Week t
first of *March* shall be this year 1680.

4) 1680
420
2

7) 2102
300

Rem. Which 2 gives Monday.

A Tabl

Table of the Movable Feasts

	Shro. Su.		East. Sun.		Asce day.		Whit. Su.	
1	*Febr.*	13	*Apri.*	3	*May*	12	*May*	22
2	*Febr.*	26	*Apri.*	16	*May*	25	*June*	4
3	*Febr.*	18	*Apr.*	8	*May*	17	*May*	27
4	*Febr.*	10	*Mar.*	30	*May*	8	*May*	18
5	*Mar.*	1	*Apri.*	19	*May.*	28	*June*	7
6	*Febr.*	14	*Apri.*	4	*May*	13	*May*	23
7	*Febr.*	6	*Mar.*	27	*May*	5	*May*	15
8	*Febr.*	26	*Apri.*	15	*May*	24	*June*	3
9	*Febr.*	10	*Mar.*	31	*May*	9	*May*	19
90	*Mar.*	2	*Apri.*	20	*May*	29	*June*	8
91	*Febr.*	23	*Apr.*	12	*May*	21	*May*	31
92	*Febr.*	7	*Mar.*	27	*May*	5	*May*	15
93	*Febr.*	26	*Apri.*	16	*May*	25	*June*	4
94	*Febr.*	18	*Apri*	8	*May*	17	*May*	27
95	*Febr.*	3	*Mar.*	24	*May*	2	*May*	12

till the Year 1710.

Yc.	Shro. Su.	East.Sun.	Asce.day.	Whit-S
96	*Febr.* 23	*Apri.* 12	*May* 21	*May* 3
97	*Febr.* 14	*Apri.* 04	*May* 13	*May* 2
98	*Mar.* 6	*Apri.* 2	*June* 2	*June* 1
99	*Febr.* 19	*Apri.* 9	*May* 18	*May* 2
700	*Febr.* 11	*Mar.* 31	*May* 9	*May* 1
1	*Mar.* 2	*Apri.* 20	*May* 29	*June*
2	*Febr.* 15	*Apri.* 5	*May* 14	*May* 2
3	*Febr.* 7	*Mar.* 28	*May* 6	*May* 1
4	*Febr.* 27	*Apri.* 16	*May* 25	*June*
5	*Febr.* 18	*Apri.* 8	*May* 17	*May* 2
6	*Febr.* 3	*Mar.* 24	*May* 2	*May* 1
7	*Febr.* 23	*Apri.* 13	*May* 22	*June*
8	*Febr.* 15	*Apri.* 4	*May* 13	*May* 2
9	*Mar.* 6	*Apri.* 2	*June* 2	*June* 1
10	*Febr.* 19	*Apri.* 9	*May* 18	*May* 2

Remarkable Days.

ine,	February 14.
ge,	April 23.

Fix'd Feasts.

cumcision, or New-years day.	*Jan.* 1
Epiphany, or Twelfth-day.	*Jan.* 6
sion of S. *Paul*.	*Jan.* 25
lom of King *Charles* I.	*Jan.* 30
tion of the Virgin *Mary*, or *Candlemas*-	*Febr.* 2
hias.	*Febr.* 24
y.	*March* 25
Evang.	*April* 25
p and *Jacob*, or *May-day*.	*May* 1
id Return of King *Charles* II.	*May* 29
bas Apostle.	*June* 11
ner, or S. *John Baptist*.	*June* 24
Apostle.	*June* 29
s Apostle.	*July* 25
olomew Apostle.	*August* 24

S. *Matthew* Apoſtle.	*September* 2
Michaelmas, or S. *Michael* the Archangel.	*September* 2
S. *Luke* Evang.	*October* 1
S. *Simon* and *Jude*.	*October* 2
All Saints.	*November*
Powder-Treaſon	*Nov.*
S. *Andrew* Apoſtle.	*Novem.* 3
S. *Thomas* Apoſtle.	*December* 2
Chriſtmas-Day.	*Decem.* 2
S. *Stephen*, Proto-Martyr.	*Dec.* 2
S. *John* Evangeliſt.	*Decem.* 2
Innocents.	*Dec.* 2

Note that S. *Matthias*-day is on *February* 25, in the Leap-Years.

To find the Moon's Diſtance from the Sun.

MUltiply her age by 4, dividing the product by 10, and the Quotient will be the ſigns that the Moon is diſtant from the Sun then the remainder multiplied by 3 will give the degrees of that ſign.

EXAMPLE

her distance from the Sun be required.

uſt 25, 1684.

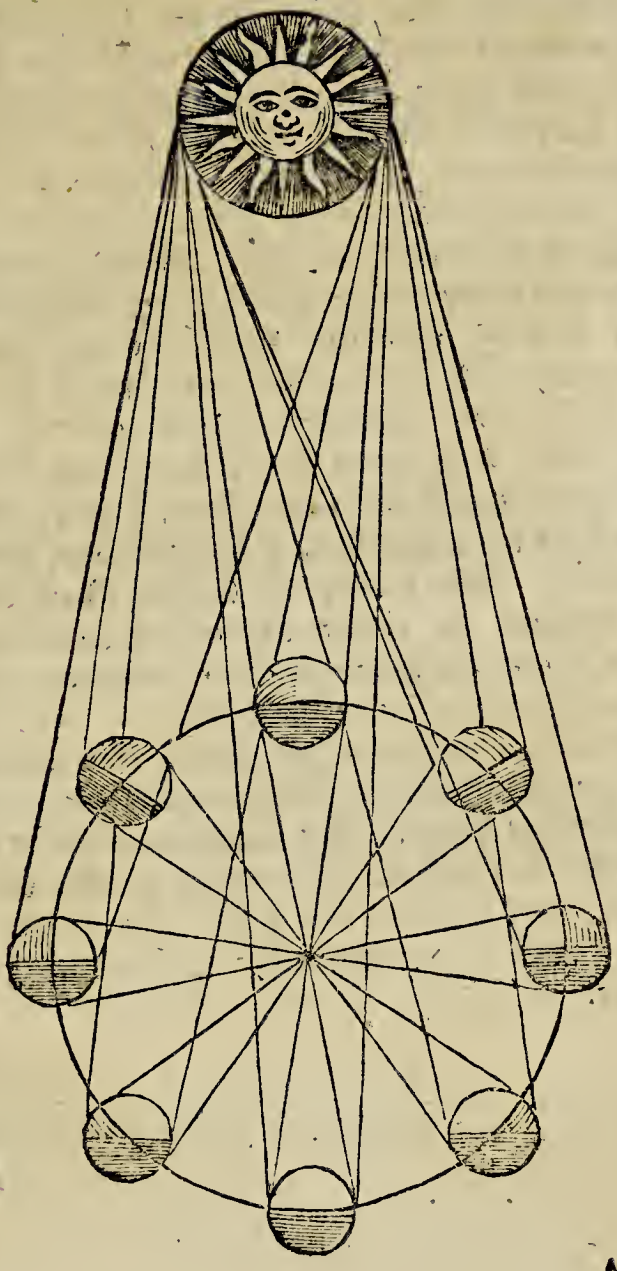
```
                1
-----------------------------------
19) 1685 (88
    152
-----------------------------------
     165
     152
-----------------------------------
      13  The Prime.
      11
-----------------------------------
      13
      13
-----------------------------------
30) 143 ( 4
-----------------------------------
      23  The Epact.
       6  Months.
      25  Days.
-----------------------------------
      54  The Sum.
      30  Subtr.
-----------------------------------
      24  The Moon's Age.
       4
-----------------------------------
10 ) 96  That is 9 h. 18 min. the
```

oon's distance from the Sun.

According.

According to this distance is the variati of her Phases: for she being a round opa globous body, and having always that Hem sphere of her that beholdeth the Sun inligh ned, she must of necessity, as she moves roun the earth, changing her situation both in r spect of the Sun and us, have a different a pearance by turning more or less of the illum nated Hemisphere towards us.

Her Phases are wont to be counted fou according to her fourfold Aspect, the Co junction being esteemed none, seeing her inligh tened half is then wholly turned from us.



Aboat

About the third day after the Conjunction, ſhe emerges in the Evening out of the Sun's Rays, and turns a ſmall part of her illuminated ſide towards us, beginning to appear ſharply horned, her horns looking backward, and tending towards the Eaſt: for note, that while ſhe increaſeth in light, ſhe followeth the Sun, and ſhineth after Sun-ſet, her inlightened part looking into the Weſt; but decreaſing ſhe goeth before the Sun, and ſhineth before his Riſing, her illuminated part looking into the Eaſt. And when ſhe comes to make about a Sextile Aſpect with the Sun, that is, about two ſigns from the Sun, is her firſt face, called Horned. She makes her ſecond Phaſe about the ſeventh or eighth day of her age, being then about 90 degrees, or at a ſquare to the Sun, appearing half inlightened, or biſected. Afterward coming to her Trine with the Sun, ſhe appears Gibbous, tum'd or ſwelled, which is her third Phaſe. Her fourth is, when in Oppoſition to the Sun, ſhe appears wholly illuminated, and is called her Full. She makes the like Phaſes in her decreaſe, but in a retrograde order.

An

An Universal Almanack.

Mar. Nov.	Aug	May. Jan.	Oct.	April July.	Sept. Dec.	June. Febr.
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

On the same day of the Week the first of *March* falls on, will the first of *February* and *November* fall; and the several days of the several Months as in that.

The Use of this Almanack.

1. *Any Day of the Week in any Month or Year being given to know what Day of the Month it is.*

As admit I would know what day of the Month

Month the first Thursday in *April*, 1680, should be.

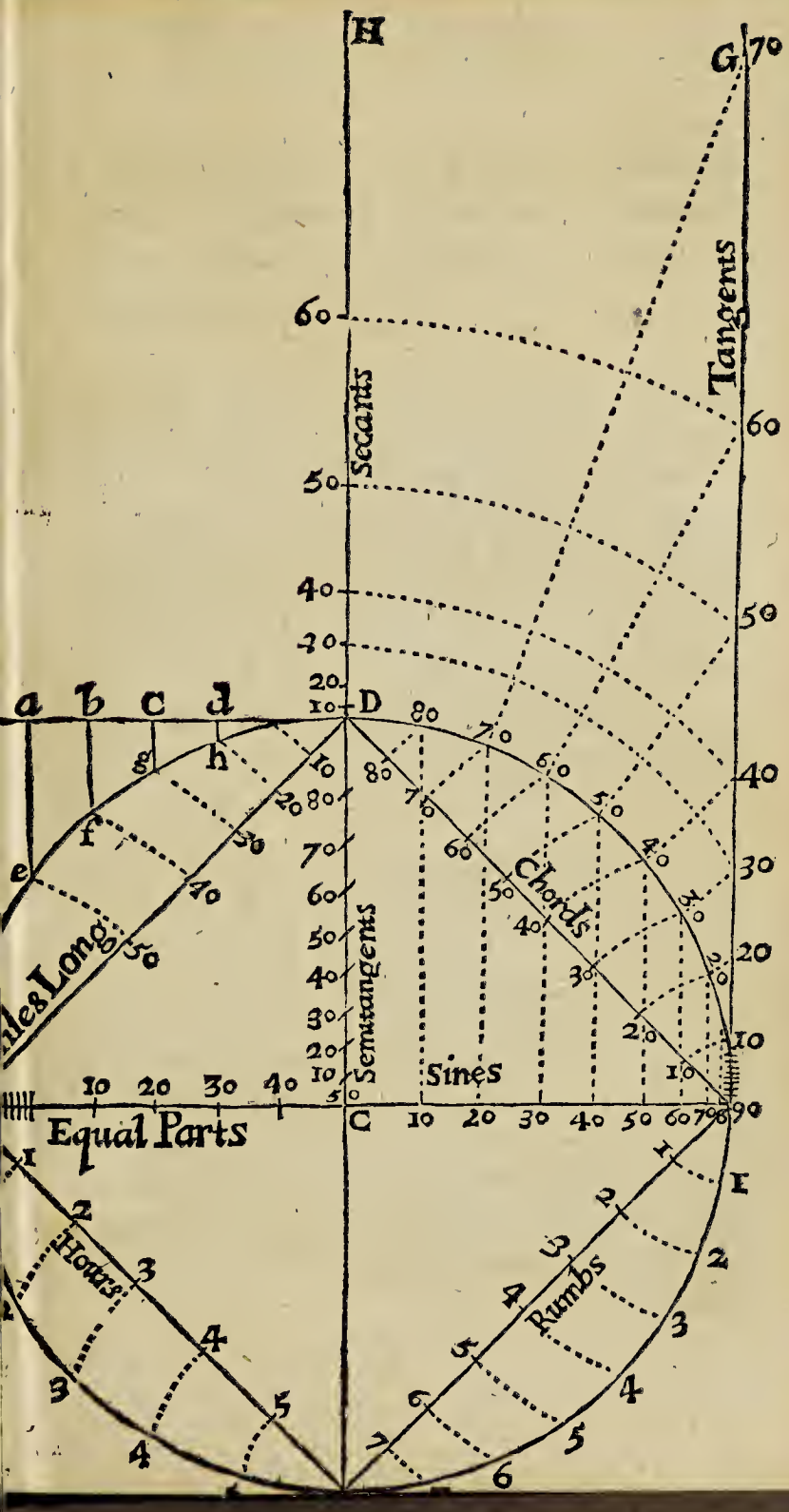
By the last Proposition I find the first of *March* to be Monday. Now looking in the Almanack (at the head thereof) for the Month *April*, under it I find these numbers, 5, 12, 19, 26, which denote the fifth, twelfth, nineteenth and twenty sixth days of *April*, to be Mondays, the same with the first of *March*; then the fifth day being Monday, Thursdays must be the first and eighth of *April*.

2. *Let it be required to find what day of the week the twenty fifth of* July *will be in the Year*, 1680.

The first of *March* will be Monday, therefore the fifth, twelfth, nineteenth and twenty sixth days of *July* will be Mondays: then the twenty sixth being Monday, the twenty fifth must be Sunday.

To

Betwixt this Page, *folio* 70, and *folio* 71, place the Cut belonging to Secants and Tangents, *&c.*


H
G
Tangents
Secants
Semitangents
Chords
Sines
D
C
Equal Parts
Hours
Rumbs
a b c d
e f g h
Miles Long

To make the Lines of Chords, Natural Sines, Tangents, Secants, Semitangents, Rumbs, Hours and Minutes Longitude.

1. DEscribe a Circle, as *A D E F*, and quarter it with the two Diameters, *A E*, *D F* at right Angles one to the other.

2. Divide the Arch *D E* into nine equal parts, and setting one foot of the Compasses in *E*, transfer the divisions of the Arch, marked 10, 20, *&c.* to the strait Line *E D*, so is *E D* a Line of Chords for every ten degrees; the single degree may be divided by guess.

3. Through the divisions 10, 20, *&c.* draw Parallels to *C, D*, which will divide *C E* into a Line of Sines.

4. On *E* raise *E G* perpendicular to *C E*, and laying a Rular over *C*, and the Points 10, 20, 30, *&c.* draw the Lines 10, 10, 20, 20, *&c.* so is *E. G.* a Line of whole Tangents.

5. Setting one foot on *C*, extend the other to the several grad. of the Tangent-Line *E G*, and describe the Arches 10, 10; 20, 20, *&c.* which makes the Line *C, D, H*, a Line of Secants.

6. Laying a Rular over *A*, and the gr. 10, 20, 30, *&c.* of the Arch *E D*, mark the Line *C D*, which becomes a Line of Semitangents.

CHAP.

CHAP. I.

NAVIGATION

Teacheth and demonstrateth how a sufficient Ship may be conducted the shortest way, and in the shortest time between any places assigned in Passages Navigable.

The Division of Navigation according to the Voyage.

IF the places assigned be at no great distance, but so that a Ship may sail in sight of Land, or within Soundings between them, then it is called a *Coasting*.

Coasting.

For the performance of which there are used only the Compass and Lead, or Sounding Line:

Line: such are the Voyages on the Narrow, or British Seas, between *England*, *Holland* and *France*; also all about the *Baltick* Seas, and indeed those in the *Mediterranean* are little other.

Navigation Proper.

But if the Voyage be to be performed in a vast Ocean, where all that's visible for many days, nay weeks together is *nil nisi pontus & æther*, then it may be called *Navigation Proper*, and requires not only the Lead-Line, and ordinary Compass, but Azimuth Compass, Charts, Log-board, and half minute Glass, with Instruments for Cœlestial Observation; as the Quadrant and Fore-staff, *&c.* and the Navigator must be able by these to find at any time in what place the Ship is, which is done by comparing it with any known place, that is, how much the same known place is situate from the ship, either towards the North or South, which is called the difference of Latitude, or towards the East or West, which, if in proper degrees, is called the difference of Longitude.

To find which place of the ship, how far she hath sailed, and consequently how far she hath to sail, and which way, or upon what course, *&c.* you have these things given, or at most times to be attained; the Latitude both of

of the place wherein ſhe is, and whence ſhe ſet ſail, as alſo that of the place ſhe intends for. Secondly her courſe which is given by the compaſs: and thirdly, the account of the ſhips way attained by the Log. How to ſtate and order theſe things given to produce thoſe required ſhall in the next Chapter be ſhewed.

Definitions.

Latitude is the diſtance of a Ship or Place from the Equinoctial, either North or South, and is counted on the Meridian.

And note, that if a ſhip ſail towards the Pole, ſhe is ſaid to *Raiſe the Pole*; but if ſhe ſail from the Pole, or towards the Equinoctial, ſhe's ſaid to *Depreſs the Pole*.

Longitude is the diſtance of a ſhip or place, Eaſt or Weſt from another counted in proper degrees: but if in Leagues, or Miles, or Degrees of the Meridian, and not in thoſe proper to the Parallel of Latitude, it's commonly called Departure, Separation, Eaſting, or Weſting, *&c.*

The Courſe is that point of the Compaſs, or Coaſt of the Horizon on which the ſhip is to be ſteered from place to place; or rather the Angle between the Rumb Line and the Meridian.

A Rumb is one Point of the Compaſs, or eleven

eleven degrees and a quarter, *viz.* the one thirty two parts of the Circumference of the Horizon, or Compaſs-Card: which is the Repreſentative of the Horizon.

A Rumb Line is a Line deſcribed by the ſhips motion on the ſurface of the Sea, ſteered by the Compaſs, making equal Angles with every Meridian.

The Rumb is the ſame with the Courſe, *viz.* the Angle between the Rumb Line and Meridian, only the one is a Portugueſe, and the other an Engliſh Word.

The

The Compass Card with its Rumbs or Points.

The Distance of the Rumbs, or Points from the Meridian.

North	South.	D.	M.	South	North.	P.
		2	49			
		5	38			
		8	26			
N by E	S by E	11	15	S by W	N by W	1
		14	4			
		16	53			
		19	41			
NNE	SSE	22	30	SSW	NNW	2
		25	19			
		28	8			
		30	36			
NE by N.	SEbyS	38	45	SW by S	NW by N	3
		36	34			
		39	23			
		42	11			
NE	SE	45	0	SW	NW	4
		47	49			
		50	37			
		53	26			
NE by E	SE by E	56	15	SW by W	NW by W	5
		59	04			
		61	52			
		64	41			
ENE	ESE	67	30	WSW	WNW	6
		70	19			
		73	07			
		75	56			
E by N	E by S	78	93	W by S	W by N	7

Navigation or Sailing, in respect of the Rumb or Point sailed on, is aptly divided into Right and Oblique.

Right Sailing.

Right Sailing is, when the Voyage is performed on some of the four Cardinal Points, that is, North, South, East or West.

If a Ship sail under a Meridian, that is, on the North or South Points, she varieth not the Longitude at all, but only changeth the Latitude, and that just so much as the number of degrees she has sailed.

If a ship sail under the Equinoctial upon the very East or West Points; she altereth not her Latitude at all: but only changeth the Longitude, and that just so much as the number of degrees she hath run.

If a ship sail directly East or West under any Parallel, she there also altereth not her Latitude, but only the Longitude; yet not according to the number of degrees of a Great Circle she hath sailed, as under the Equinoctial: but more than so many according as the Parallel is remoter from the Equinoctial towards the Pole: for the less any Parallel is, the greater is the difference of Longitude in sailing so many degrees of a Great Circle.

Oblique

Oblique Sailing.

Oblique Sailing is when the ſhip runneth upon ſome Rumb between any of the four cardinal Points, making an Oblique Angle with the Meridian: and then ſhe changeth continually both Latitude and Longitude.

The Diviſion of Navigation according to the Chart.

There be three kinds of Oblique Sailing, or rather methods of protracting the way, and pricking down the place of the ſhip.

Plain Sailing.

The firſt is called Plain Sailing, manifeſting all the varieties of the ſhips motion on a Plain, where all the Meridians are made parallel, and the Parallels at right Angles to the Meridians, and the degrees of each Parallel equal to thoſe of the Equ. Which tho notoriouſly falſe in it ſelf, ſuppoſing the Earth and Sea to be a plain flat, and each parallel equal to the Equator, yet by breaking a long Voyage into many ſhort ones, a Voyage may pretty well be performed thereby, near the ſame Meridian.

Mercator's

Mercator's Sailing.

The ſecond is called *Mercator*'s, or more
ly *Wright*'s Sailing, or ſailing by *Wright*'s
art, which demonſtrateth alſo on a Plain
motion of the Ship, upon any courſe aſ-
ned true in Longitude, Latitude and Di-
nce, the Meridians being alſo parallel, and
Parallels of Latitude ſtrait Lines.

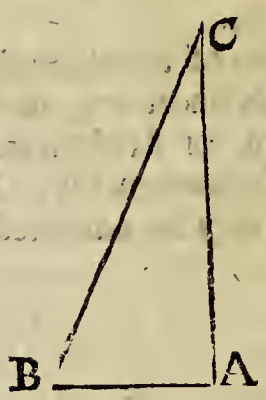
Great-Circle-Sailing.

The third is Great-Circle-Sailing, which
cheth how upon, or by a great Circle, paſ-
g through any two places aſſigned, the ſhip
y be conducted by a skillful Seaman: and
is the ſhorteſt way between place and
ce that may be.
The Operation of all which three kinds ſhall
hewed by Delineations, or Geometrically;
Computation, or Arithmetically; and Me-
nically or Inſtrumentally. If the uſe of a
e of Chords may be admitted in Geometry.

CHAP II.

Plain Sailing.

FOr Methods ſake make always the fore p
of the Book, Slate, or whatever elſe y
draw, or work upon, the North part, t
neareſt to you the South, then will that part
wards the Right Hand be the Eaſt, and that
wards the Left Hand the Weſt, and imag
that by the Rumb Line, Meridian, and Para
of Latitude will always be formed a right
gled Triangle, as the Triangle B, A, C, ri



angled at A, (for ſo ſhall the right Angl
always marked throughout the work;) T

hat part of the Meridian, or North and uth Line contained between A and C the fference of Latitude, the ſide B A the Deture, B C the diſtance ſailed, the Angle C Courſe, and the Angle B the Compl. reof. Any two of which with the right gle being given, the Triangle may be proted, and the other three parts found, as in following Examples.

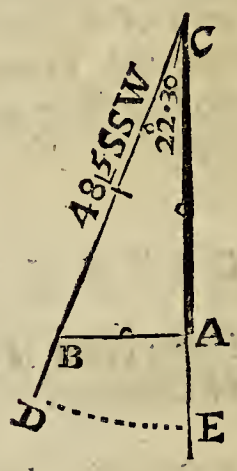
CASE I.

Courſe and Diſtance given to find the Difference of Latitude and Departure.

Admit a ſhip from the Latitude fifty deees, ten minutes North, ſail S. S. W. 48·5 les, and you require the Latitude ſhe's in, l her departure from the Meridian.

Geometry.

First draw the North and South Line A



and taking with the Compaſſes ſixty degr
from the Line of Chords, ſet (becauſe
ſails Southward) one foot in ſome point
wards the North on the ſaid Line A C, a
C, and deſcribe the Arch D E, and lay the
on the Courſe two points, or twenty two
grees, thirty minutes from E to D, and dr
C B. Secondly, taking the given diſta
8·5 from the Line of equal parts, lay it
he Rumb Line C B, from C to B. Laſ
from B let fall the perpendicular B A, wh
includes the Triangle B A C, whoſe requi
parts B A and A C being taken one after
ot

ıer between the Compaſſes may be meaſured applying to the Scale.

Arithmetick.

Say as the Radius 10
to the diſtance run C 48·5 miles—— } 1, 685741
is the Sine of the ourſe 22 deg. 30 m. } 9, 582870

11,268582

the departure 18·56
hich in this Example is Weſting.

Then again,
the Radius——————10
to the diſtance B C, 48·5--1,685742
is the Coſine of the ourſe 67 deg. 30 min. } 9,965615

11,651357

the difference of Latitude C A 44·8.
hich becauſe ſhe ſailed towards the Equator, u muſt ſubſtract from the Latitude ſhe ſet om, *viz.* 50 degrees, 10 minutes, and the emainder 49 deg. 25 minutes is the Latitude e's arrived in. If C A had been more than , you muſt have divided by 60.

By this Canon was the Table, beginning ge made; and by that Table may this

Propoſition be readily worked, for by loo
ing the Courſe on the head, and the diſtan
down the Left Hand Column in the comm
Angle is the difference of Latitude and D
parture under their reſpective Titles. If t
Courſe be above four Points, look it at t
bottom, and if the diſtance be too big to
found in the Table at once, take it at ſeve
times.

Inſtrument by Gunter's Scale.

Set one foot of the Compaſſes in the Radi
or Sine of 90 degrees, and extend the other
two points on the Sine Point Line, or on
deg. 30 min. of the Sines: Then keeping th
extent, ſet one foot in 48·5 of the Line
Numbers, and turning the other backwar
viz. that way you did turn it from the f
term the Radius, to the third two Points, a
the other foot will fall on 18·6 the depart
as before. Again ſet one foot in the Radi
and extend the other to ſix points (whic
the Compl. of two Points, the Courſe:) th
keeping that extent, ſet one foot in 48·5 of
Line of Numbers, and turning the other f
back it will fall on 44·8, the difference of L
as above.

Which difference of Latitude and
parture being found by the eſtimate
ſtance from the Log, which by m
accid

idents is viciated, as by the Wind and Seas
en high, throwing it after the Ship, or
rrents, *&c.* is naught, and not to be relyed
, but as soon as the Sun or Stars appear,
e Latitude ought to be observed by the Rules
lowing towards the end of this Treatise,
ich if found differing from what it was made
the former way, called Dead Reckoning,
u must take the difference of this last observ-
Latitude, and the Latitude you departed
om; and with this true difference of Lati-
de, and the Course by the following Pro-
sition find the Departure and Distance.

CASE II.

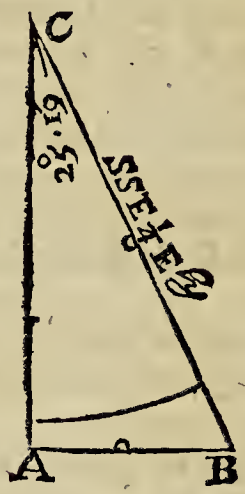
e Course and Difference of Latitude being given to find the Departure and Distance.

Admit a ship sail from Latitude 48 degrees,
o minutes North, S. S E. a quarter Easterly,
ll she be in Latitude 47 deg. 21 min. and the
eparture and Distance sailed be required.

Geometry.

First, draw the North and South Line C
and ſubſtracting the Latitudes one from the
ther, take 69 miles, their difference, and
from C to A, making the point C towards t

Lat. 48 deg. 30 m



Lat. 47 deg. 21 m.

Upper, or North End of the Line, and
A, raiſe the Perpendicular B A.

Laſtly, taking the Radius, and ſetting o
foot in C, with the other deſcribe the Ar
D E, and lay thereon two Points and a quart
or twenty five degrees, nineteen minutes fro
E to D, and draw C D, which completes t

Triang

angle B A C, whose required parts may be
asured by the Scale.

Arithmetick.

Say, as the Cosine of the
urse five Points, three } 9,956148
rters,

to the difference of Lat.
miles. } 1,838849
is the Radius 10,000000

11,838849

the distance sailed C B
3. } 1,882701
Then, as the Radius 10,000000

o the distance sail'd C B
3 } 1,882701
is the Sine of the Course.
o Points and a quarter of } 9,631059
Angle C

the Departure A B
6 miles. } 11,513760

By this Canon was the second Traverse Ta-
calculated; and by that Table may this
position be answered by inspection: for by
king the Course on the Head, and the dif-

ference of Latitude down the left Column
the common Angle you have the Departure.

Inſtrument.

Set one Foot of the Compaſſes on the S.
Line, in five Points and three quarters, t
compl. of the Courſe; and extend the oth
to the Radius; then keeping the Compaſſes
the ſame extent, ſet one foot in 69, the d
ference of Latitude on the Line of Numbe
and turn the other forward, and it will fall
76·3 the Diſtance run.

Then ſet one foot in the Radius, and exte
the other to two Points and a quarter; th
keeping the Compaſſes at the extent, ſet o
foot in the diſtance ſailed, and turn the oth
back (becauſe it was turned back before fro
the Radius to two Points and a quarter, and
will fall on 32·6 the Departure.

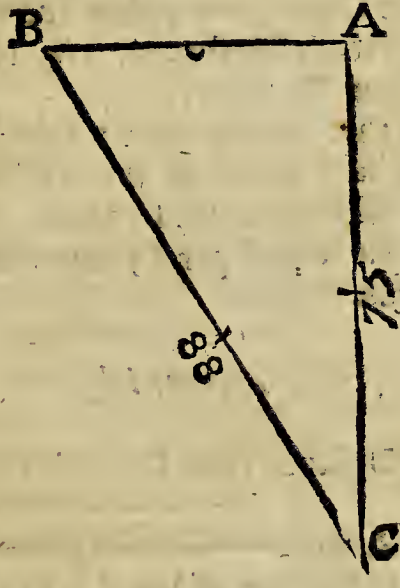
If having no cauſe to ſuſpect the diſtance f
the former, or any other reaſons, and are
ſured in your ſelf of having made a good eſ
mate thereof: but miſtruſt the care or skill
the Helmſman, that he has let her yaw and f
off, or that you have neglected the Variatio
then with the true difference of Latitude, a
the diſtance by the following Propoſition, fi
the Courſe and Departure.

CAS

CASE III.

Difference of Latitude and Distance sailed iven, to find the Course and Departure.

dmit a ship sail from Latitude forty two rees, fifteen minutes North, on some point ween the North and West eighty eight es, and then finds her self in Latitude, forty ee degrees, thirty minutes: what is her rse and Departure?



Geometry.

Having drawn the Meridian Line A
prick the difference of Latitude seventy
miles from C to A; and on the Point A r
the Perpendicular B A; then take the
stance eighty eight miles, and setting one f
in C, with the other cross B A, as it will so
where as in B, and draw B C, now the L
B A measured on the equal parts is the D
parture. Also upon C as a Center, w
sixty degrees of the Chords, describe the Ar
D E, which measured on the Chords or Rum
shews the Course two points and three quart
from the North Westward, *viz.* N. N. W. t
parts of four Westerly.

Note, that where ever a side is to be me
sured, or laid down as the Distance, Depa
ture, or Difference of Latitude, you must
ways use the equal parts; but when an Ang
the Chords.

Arithmetick.

As the Distance run, C B 88-1:944483

Is to the Radius ——— 10 ———
So is the Difference of La- } 1,875061
titude C A 75 ——— }

11,875061

To the Cosine of the Course, Angle B 58 degrees, 27 m. } 9,930578
Whose Compl. C 31 deg. 33 min. is two Points and three quarters from the Meridian, *viz.* N. N. W. three parts of four Westerly.
Then as the Radius —— 10 ——

Is to the Distance run C B 88 miles. } 1,944483
So is the Sine of the Course's Angle C, 31 deg. 33 min. } 9,718703

To the Departure from the Meridian A B 46 m. West. } 11,663186

By the Gunter.

Set one foot in 88 of the Line of Numbers, and extend the other to 75; then set one foot in the R. or Sine of ninety degrees, and turn the other backward, and it will fall in the Sine of 58 degrees, 27 min. the Compl. of the Course.

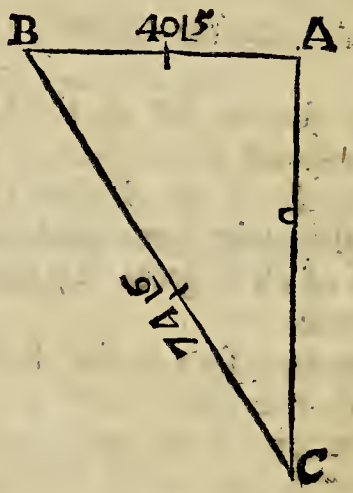
Again set one foot in the Radius, and extend the other to the Sine of 31 deg. 33 min. then set one foot in 88 min. and turn the other backward, and it will fall on 46 min. the Separation from the Meridian.

CASE

CASE IV.

The Distance run, and Departure from the Meridian given, to find the Course and Difference of Latitude.

A ship being in the Latitude 50 deg. 00 m. North, sails North Westwards, till her distance run be 74·6 miles, and the Departure be 40·5, from which is demanded the Course and Difference of Latitude, and consequently the Latitude the ship is in.



Geometry.

Having drawn the Meridian A C on the Point A, taken ſomewhere towards the upper or North end of the Line (becauſe the ſhip ſails Northward) raiſe the Perpendicular B A, laying thereon 40·5 miles, the Departure from A to B; then take the diſtance 74·6 miles, and ſetting one foot in B, with the other croſs the Meridian A C in C, and draw B C.

Arithmetick.

As the Diſtance run B C 74·6 ——— } 1,872739

Is to the Rad. ——— 10 ———

So is the Departure B A 40·5 -- 1,607455

To the Sine of the Courſe 11,607455
9,734716

Angle C, 32 degrees, 53 minutes, which is three Points from the Meridian, *viz.* North Weſt by North nearly.

Then as the Rad. ——— 10 ———

Is to the diſtance B C 74·6 ----- 1,872739

So is the Coſine of the Courſe, s. 57 deg. 7 min. } 9,924164

11,796903

To the difference of Latitude A C 62·6 miles, which

which turned into Degrees, is one degree, three minutes, and is to be added to 50 degr. 00 minutes, the Latitude she departed from, because she raises the Pole: so is the sum 51 deg. 3 min. the Latitude the ship is in.

By the Gunter.

Set one foot of the Compasses in 74·6 miles, and extend the other to 40·5; then keeping the same extent, set one foot in the Sine of 90 degrees, and turn the other backward, and it will fall on the Sine of 32 degr. 53 min. the Course.

Again set one foot in the Sine of 90 degrees, and extend the other to the Sine of 57 degrees, 7 minutes, the compl. of the Course, then retaining the same extent, set one foot in 74·6 of the Line of Numbers, and turn the other backward, and it will fall on 62·6 the Departure.

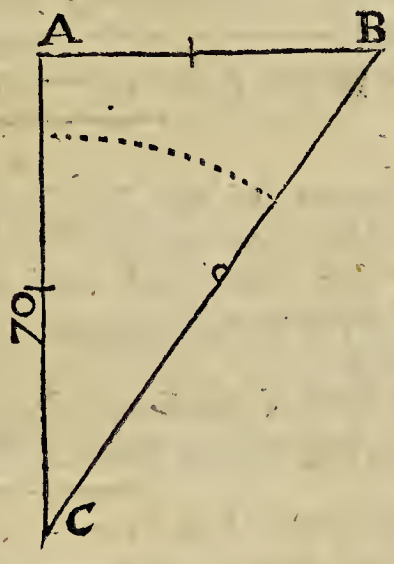
CASE V.

The Alteration of Latitude and Departure from the Meridian given, to find the Course and Distance run.

A ship from the Latitude 50 deg. 00 min. North, sails North-Eastward till she has altered her Latitude 1 deg. 10 min. or 70 miles, and

is

is departed from the Meridian 51 miles; what is her Course and Distance?



Geometry.

Having drawn A C, and laid thereon the 70 minutes from C to A, and on A raised the Perpendicular A B, lay 70 m. from A to B, and draw B C.

Arithmetick.

Arithmetick.

As the difference of Latitude A C 70 miles. — 1,845098
Is to the Rad. — 10
So is the Departure A B 51 — 1,707570

11,707570

To the Tangent of the Course, Angle C, 43d. 14m. — 9,862472

Which is three Points and three quarters, or North-East by North, three parts of four Northerly, nearly.

Then as the Sine of the Course, Angle C, 43 degrees, 14 min. — 9,835672
Is to the Departure, A B 51 — 1,707570
So is the Radius — 10,000000

To the distance B C 74.4 miles. — 11,707570 / 1,871898

By the Gunter.

Set one foot of the Compasses in 70 m. and extend the other to 51 of the Line of Numbers; then keeping the same extent, set one foot in the Tangent of 45 degrees, turning the other backward, and it will fall on the Tangent 43 degrees, 14 min. the Course.

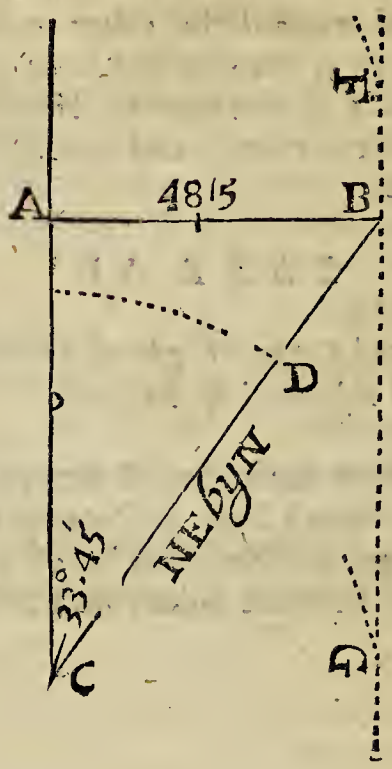
Again

Again ſet one foot in the Sine of 43 degr. 14 min. and extend the other to the Sine of 90 degrees, then keeping the ſame extent, ſet one foot in 51 of the Line of Numbers, turning the other forward, and it will fall on 74 4 the diſtance.

CASE VI.

The Courſe and Departure given, to find the Diſtance and Difference of Latitude.

A ſhip from Latitude 48 degrees, 30 min. North, ſails North Eaſt by North, till her departure from the Meridian be 48·5 Leagues; what is the Diſtance ſailed, and Difference of Latitude?



Geometry.

Having drawn the Meridian A C, and on the Point C taken ſomewhere towards the lower or South End, as a Center with the Chord of 60 degrees, deſcribed the Arch D E, and laid thereon three Points from E to D, and thereby drawn the Rumb Line C B, at the extent 48·5, taken from the Scale of equal parts, draw a Parallel to A C, as F G cutting the

the Rumb Line in B, from which Point B let fall a Perpendicular to A C as B A.

Arithmtick.

As the Sine of the Course 33 deg. 45 min. Angle C } 9,744732

Is to the Departure, A B 48·5 --- 1,685742
So is the Radius ——— 10 ———
To the Distance C B 87·3 Leagues. } 11,685742 / 1,941010
Then, as the Radius ——— 10 ———

Is to the distance run C B 87·3 --- 1,941010
So is the Cosine of the Course, or s. 56 deg. 15 min. } 9,919846
11,860856
To the difference of Latitude A C 72·6 Leagues. } 1,860856

By the Ganter.

Set one Foot of the Compasses in the Sine of 3 Points, and extend the other to the Radius, or Sine of 8 Points; then keeping that extent, set one foot in 48·5 of the Line of Numbers, and turn the other forward, and it will fall on 87·3 the Distance sailed.

Again, set one foot in s. 8 points, and extend the other to s. 5 points; then set one foot

foot in 87·3 Leagues, and turn the other backward, and it will fall on 72·6 Leagues, the Difference of Latitude, which is 217·8 miles, or minutes, which divided by 60, makes 3 degrees, 37 minutes, which, becauſe ſhe raiſes the Pole, I add to 48 deg. 30 min. the Latitude ſhe departed from, and the ſum 52 deg. 7 min. is the Latitude ſhe's arrived in.

Thus having laid down the ſix Caſes of ſailing, I ſhall annex a Series of Blank Examples to the former Caſes, wherein the Phraſe is ſomewhat altered.

1. If I ſail Leagues
how many degrees ſhall I have raiſed the Pole?

2. If I ſail till I raiſe the Pole,
or alter my Lat. deg. min. I demand how many miles I have ſailed?

3. A ſhip from the Lat. N,
ſails till ſhe be in the Lat.
I demand the diſtance ſailed, and the Departure from the Meridian?

4. Sailing Miles between the North and Weſt, till I raiſe the Pole, or alter my Latitude deg. min. on what Courſe have I ſailed, and how far am I departed from the firſt Meridian?

5. If

5. If in ſailing miles, I be miles Weſt from the Meridian of the place I departed from, on what point have I ſailed, and how much have I raiſed or depreſſed the Pole?

6. If I ſail till I be miles from the Meridian of the Place of my Departure: how many miles ſhall I have ſailed, and how much ſhall I have depreſſed the Pole, or altered my Latitude?

CHAP. III.

A Traverſe

IS the Variation, or Alteration of the Ships motion upon the ſhifting of Winds, *&c.*

Sailing in reſpect of wind.

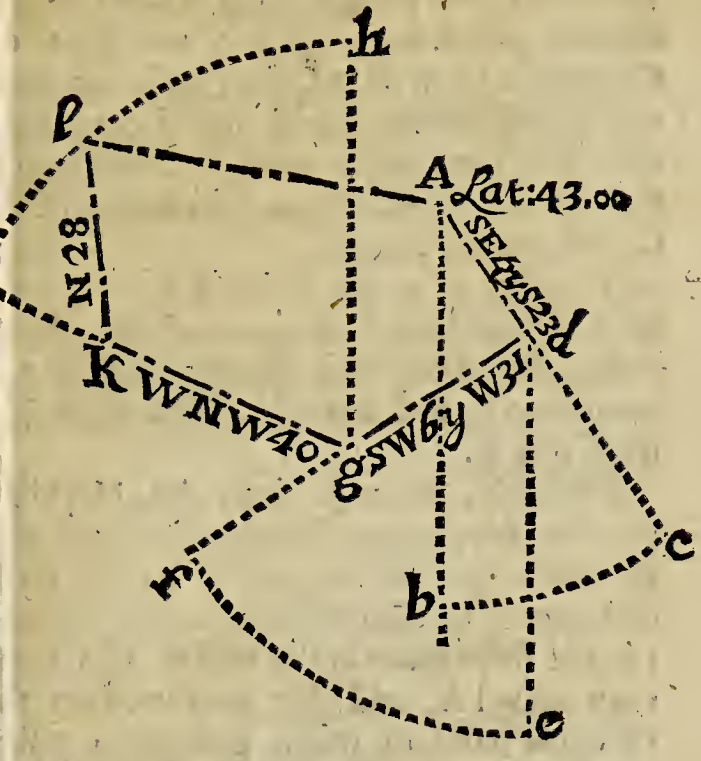
Sailing in reſpect of the Wind, is either before a Wind, by a Wind, or Larging.

If

If a ſhip ſail by, or againſt a Wind, there ought to be an allowance for her Lee-way, and that more or leſs, according to the Growth and Surge of the Sea, and Mould of the Ship, and Sail ſhe bears, *&c.*

EXAMPLE I.

A ſhip from Latitude 43 deg. 00 min. N. ſails S. E. by S. 23 miles, and then ſails S. W. by W. 31 miles, and afterwards W. N. W. 40 miles: and laſtly, N. 28 miles: what is the Courſe and Diſtance ſailed from the firſt place of Departure; and the Latitude ſhe is now in?



Geometry.

ke any convenient Point on your Slate, per, for the Ships place at first, as A, rom thence having drawn the Meridian with 60 degrees of the Chords, describe rch b c, and lay thereon three Points from , then draw A c, and lay thereon twenty

three miles from A to d; ſo have you prot
ed the firſt Courſe and Diſtance.

Secondly, through the Point d, draw
Meridian d e parallel to A b, and with
degrees of Chords, ſetting one foot of
Compaſſes in d, as a Center deſcribe the
e f, laying thereon five Points from e to f,
draw a f, then prick 31 miles from d to g,
the Line d f, ſo have you laid down the ſe
Courſe and Diſtance.

Thirdly, from the Point g draw g h pa
to A b, and with 60 degrees of the Chord
ſcribe the Arch h i, laying thereon 6 p
from h to i, and draw g i, then prick 40
from g to k.

Fourthly, from k draw the Meridian
parallel to A b, and becauſe ſhe ſails now
der the very Meridian it ſelf, lay 28 miles
diſtance on this Rumb from k to l, which
l is the ſhips place at the end of this Trav
then draw l A, and that meaſured on the
of equal parts, or miles, gives 50·4 miles,
direct diſtance from the place of Depar
and the Angle A l k being meaſured o
Chords, gives 82 deg. or 7 Points and a
ter from the Meridian; ſo that if ſhe had
ed on a ſtraight Line, and ſingle Courſe
the firſt Point A to l, that Courſe had
Weſt by North, and a quarter Weſterly,
the diſtance 50·4 m. and if ſhe were
back again from l to A, ſhe muſt ſtand

outh, and a quarter Eaſterly till ſhe has 50·4 m.

Arithmetick.

e Radius ———	10 ———
the diſtance on the Courſe 23 m. ———	1,361726
the Sine Compl. of Courſe, *s.* 56 d. 15 m.	9,919846
ne difference of Lat. firſt Courſe, 191 m.	11,281572
as the Radius ———	10 ———
he diſtance A l 23 n. n the firſt Courſe	1,361726
the Sine of 3 points, or g. 45 min. Angle d A B ſt Courſe ———	9,744739
ne Departure in the firſt e 12·8 ———	11,106465

us proceeding with the ſeveral Courſes iſtances given, find the Departures and ences of Latitude to them all.

he Courſe be between the North and then the Difference of Latitude is called ing; and the Departure, Eaſting; if the e be in the North-Weſt Quarter, then

the difference of Latitude is called North and Departure Westing.

If the Course be between the South East, the Difference of Latitude is c Southing and the Departure Easting, *&c.*

Now place all the said Differences of tude and Departures in a Table; the Nort under Northing: Southings under South the Eastings in the East Column; and Westings in the West Column, as ben Then add up all the Northings, as likewis Southings; and so the Eastings, as als Westings. Lastly, substract the sum o Northings from that of the Southings, Southings make most, or the sum o Southings from the Northings, that you have their difference, which is the diffe of Latitude, also take the difference o Totals, of Easting and Westing for th parture: by which difference of Latitud Departure, according to the fifth Case the direct Course and Distance.

	d.	m.
Latitud. Depart.	43	00
Diff. Lat.	0	7
Lat. she's in.	43	7

ourse.	di.	N.	Sou.	East	We.	
. by S.	23		19·1	12·8		
v. by W.	31		17·2		25·8	
N. W.	40	15·3			36·9	
Noth.	28	28				
Sum		43·3	36·3		62·7	
Take		36·3		12·8	12·8	
Rest		7			49·9	D. W.

As the Diff. Lat. 7 m. —— 0,845098

Is to the Radius —— 10
So is the Dep. 49·9 m. —— 1,698106

11,698106

To the Tang. of the Course 82 degr. 1 min. } 10,853008
And as the Sine of the Course 82 deg. 1 min. } 9,995770

Is to the Departure 49·9 1,698106
So is the Radius —— 10

11,698106

To the Dist. 50·4 m. —— 1,702336

By the Gunter.

Set one foot in 8 Points, and extend th
ther to three Points; then with the same
tent set one foot in 23 m. and turn the o
backwards, and it will fall in 12·8 the Eas
in the first Course.

Set one foot in 8 points, and extend th
ther to 5 points; then set one foot in 2
and turn the other backward, and it will fa
19·1 the Southing in the first Course.

Secon

econdly, ſet one foot in 8 points, and ex-
the other to 5 points; then keeping the
extent ſet one foot in 31 m. turn-
he other backward, and it will fall in 25·8
Weſting in the ſecond Courſe.

t one foot in 8 points, and extend the o-
to three points; then keeping the ſame
nt, ſet one foot in 31 m. turning the o-
ther backward, and it will fall in 17·2 the
hing in the ſecond Courſe.

hirdly, ſet one foot in 8 points, and ex-
the other to ſix points; then retaining the
extent, ſet one foot in 40 m. turning the
backward, and it will fall on 36·9 the
ing in the third Courſe.

t one foot in 8 points, and extending
ther to two points; then ſet one foot in
. turning the other backward, and it will
n 15·3 the Northing in the third Courſe,
h Northings, Southings, Eaſtings, *&c.* being
ted as before, and the ſums ſubſtracted,
Difference of Latitude will be 7 m. North,
he Departure 49·9 Weſt.

ien ſet one foot in 49·9, and extend the
to 7 m. afterwards remove one foot
5 deg. turning the other backwards, and
l fall on 82 deg. which is the Courſe from
North Weſtward. Again, ſet one foot in
ine of 82 deg. and extend the other to
ine 90 deg. then keeping the Compaſſes

at the ſame extent, ſet one foot in 49°9, t
ing the other forward, and it will fa
50°4 m. the direct diſtance from the firſt
of Departure.

EXAMPLE II.

A Ship being bound to the Eaſtward,
finding the Wind variable, a ſmall
ſmooth Water plies upon theſe ſeveral Co
with the diſtances on each Courſe as follow

The Larboard Tack on Board, Wind
S. S. W. to S. and ſo to S. S. E. and E.

	Mil
S. E. by E. half Eaſterly	5
E S. E.	
E. by S.	
E. half Northerly	

The Starboard Tack on Board, Wind
E. S. E. E. *&c.*

S. S. W.	
S. by W.	
South	
S S. E.	
S. E. by S.	

I require the direct Courſe and Diſ
from the firſt place of Departure.

is Example I ſhall work only by the Tra-
Table, *page* to ſhew the uſe
of.

urſe.	P.	D.	N.	Sou.	Eaſt	W.
y E. $\frac{1}{2}$ E.	$5\frac{1}{2}$	5		2.4	4.4	
S. E.	6	4		1.5	3.7	
by S.	7	7		1.4	6.9	
$\frac{1}{2}$ N.	$7\frac{1}{2}$	3	0.3		3.	
S. W.	2	5		4.6		1.9
by W.	1	6		5.9		1.2
uth	0	4		4.0		
S. E.	2	7		6.5	2.7	
. by S.	3	3		2.5	1.7	
Sum.				28.8	22.4	3.0
			0.3	0.3	3.1	
				28.5	19.3	

Having drawn several Columns, and the
set down the several Courses and Distances
in the Specimen, turn to the Traverse Ta
page looking the Course on the Hea
the Table, if under 4 points; but at the
tom, if above 4 points, and look the Dista
in the Left Hand Column, and in the squar
meeting will be the Difference of Latit
and Departure under the respective Ti
Thus, above 5 points and a half, and righ
gainst 5 m. I find over the Title Diff. Lat.
m. the Diff. of Lat. and over Dep. 4·4 m.
Dep. in the first Course, which being pla
in their proper Columns, according as they
Northing, or Southing, *&c.* proceed in
manner with all the other Courses and Dis
ces, entring the corresponding Difference
Latitude and Departure in their Colun
then add up the Columns of Differenc
Latitude and Departure, substracting the
Difference of Latitude from the greater;
the lesser Departure from the greater, and
Remainders are the whole Difference of L
and Departure she hath made from the plac
her Departure; so in this Example she is
miles to the South of the place of Depar
and 19·3 miles E. which by Case 5, I find
Course South East, by South two degrees
therly, and distance 34·5 m.

EXAM

EXAMPLE III

nno 1679, from the ninth to the tenth of *l*, Courſes and Diſtances ſailed by the Log, e a Wind from the South South Eaſt vari- to the South Eaſt by South, an indiffe- Gale, and the Variation of the Compaſs, bſervarion 5 degrees Eaſt, the true Courſe direct Diſtance is required.

	m.
	32
l. E.	22
t. by E.	4
. by S.	20
S. W.	5
	83

The Courſe being computed by the former thod is Eaſt 14 deg. South and the Diſtance miles; but by reaſon of the Variation the e Courſe is Eaſt 19 deg. South, and diſtance miles, from which I make my Difference Latitude 14 m. But by my obſerved La- ude 29 deg. 22 m. S. I find I am 4 m. more rth than that Account, which ſeeing I have cauſe to ſuſpect my Courſe, and have been eful in trying, and find no Current, I can ribute to nothing but her Lee-way, which I have

have not accounted for, taking it to be litt
ſmooth Water: therefore by the true Dif
ence of Latitude 10 m. and the Diſtance
m. I compute my Courſe according to Caſe
and find it E. 13 deg. S. which will again g
my Departure 43 m. and Diff. 10 m. acc
ing to obſervation. But if having been v
experienced in the qualities of my ſhip,
certain what allowance to have made for I
way, yet had not obſerved the Variation
ſhould have argued another way, and attri
ted the error to Variation, eſpecially if I
made any Tryal for a Current.

To be able to give a good account of
ſhips place is no light eaſie thing, but requ
beſides an experienced Judgment in eſtimat
the ſhips way, and frequent obſervation of
Latitude, a perfect underſtanding the qua
cations of the ſhip, a true and conſtant ob
vation of the Variation, and no long omiſſ
of the tryal for the diſcovery of Currents:
there be an omiſſion of the obſervation of
one of theſe, it may nevertheleſs be found
the other: but if two or more be omitted
will be doubtful to which of them to attrib
the error, and conſequently, hardly any t
correction to be made. Yet note this, tha
you have omitted every thing but the Cou
and Diſtance, as moſt commonly it happe
then if the Courſe be leſs than four points fr
the Meridian, take the Courſe to be true, a

W

with that, and the true difference of Latitude find the Departure: but if the Course be above 4 Points from the Meridian, take your distance and true difference of Latitude, produced by observation, and by them find the Departure; or sometimes you may retain the observed difference of Latitude, and the Departure (found by the dead Reckoning) to find the Course and Distance, the error being imputed partly to the Course, and partly to the Distance. But once in two or three days, if it may be, observe carefully the Variation, which will give great light in your Easting and Westing, as well as perfect your Course for its regular, and as orderly as any thing in the world can be to them that well observe it. If at any time it fail you, and you find a sudden alteration of Variation suspect your Compass, and look for the Iron that's about it.

Many neglecting the Observation of the Variation, by arguing from their reckonings, many times talk of Variation, where there's none, and sometimes East-Variation, when indeed it's West; and sometimes tell us of no Variation, or a sudden mutation, where there's a great Variation, and very regular. Others again carrying an Azimuth Compass, and being skilled in observing the Variation, lay all errors in reckoning to Currents, making many hundreds more than are in being.

of

Of Currents, and how to allow for them in your Account.

If a Current ſet directly againſt a ſhip in her Courſe, it leſſens her diſtance ſailed by ſo much as is the drift or race of the Current in the ſame time.

If a Current run directly with the Courſe a ſhip ſails, it will augment her diſtance by ſo much as is the drift of the Current in the ſame time.

If a Current thwart the ſhips Courſe, it not only augments, or diminiſheth her diſtance, but makes her err in her Courſe, ſo that without knowing where they are (which I ſhall at the end of this Treatiſe ſhew how to find) and when found care taken to prevent the errors that would proceed from them, by allowing for them in the Reckoning, you may in ſailing to ſome ſmall lone Iſland, be at ſuch loſs, that you may not know which way to ſteer, as it has happened to ſeveral.

To avoid this, it's uſual now not to make directly towards ſuch Iſlands: but to get into the Latitude thereof while they are certain whether they be to the Eaſt or Weſt of it, and then keep in that Latitude, ſailing directly Eaſt or Weſt, according as the place lieth, 'till they get ſight thereof.

But to proceed, it's abſolutely neceſſary to know

know how to allow for the Currents upon any Rumb whatever, so that by observation of your Latitude you may by computation find your true Longitude.

To make a Plain Chart.

As to make a particular Chart for a Voyage between the Parallels of 43 deg. and 50 deg. North Latitude, and to contain 5 deg. of Longitude.

First, draw the Meridian, or North and South Line A B, and cross it at right Angles in the Point A, with another right Line A D, representing the Parallel of 43 deg.

Then taking any convenient length for a degree, prick it seven times from A to B, marking them 43 44, 45, 46, *&c.* and five times from A to D, marking them 1, 23, *&c.* Through D, 4, 3, 2, *&c.* draw Parallels to A B for Meridians, and through B, 50, 49, 48, *&c.* Parallels to A D, for Parallels of Latitude subdividing each degree both of the extreme Parallels and Meridians into 60, 30, 20, 10, or 12 equal parts as it will bear, in some convenient place depicting the Compass, with the Rumb-Lines drawn forth quite through the Chart.

To

To lay down a Place on the Chart.

Let A repreſent ſome place in the Latitude 43 degrees, and I would lay down another place that's 3 degrees, 30 minutes Eaſt thereof, and in Latitude 46 degrees, 30 minutes North.

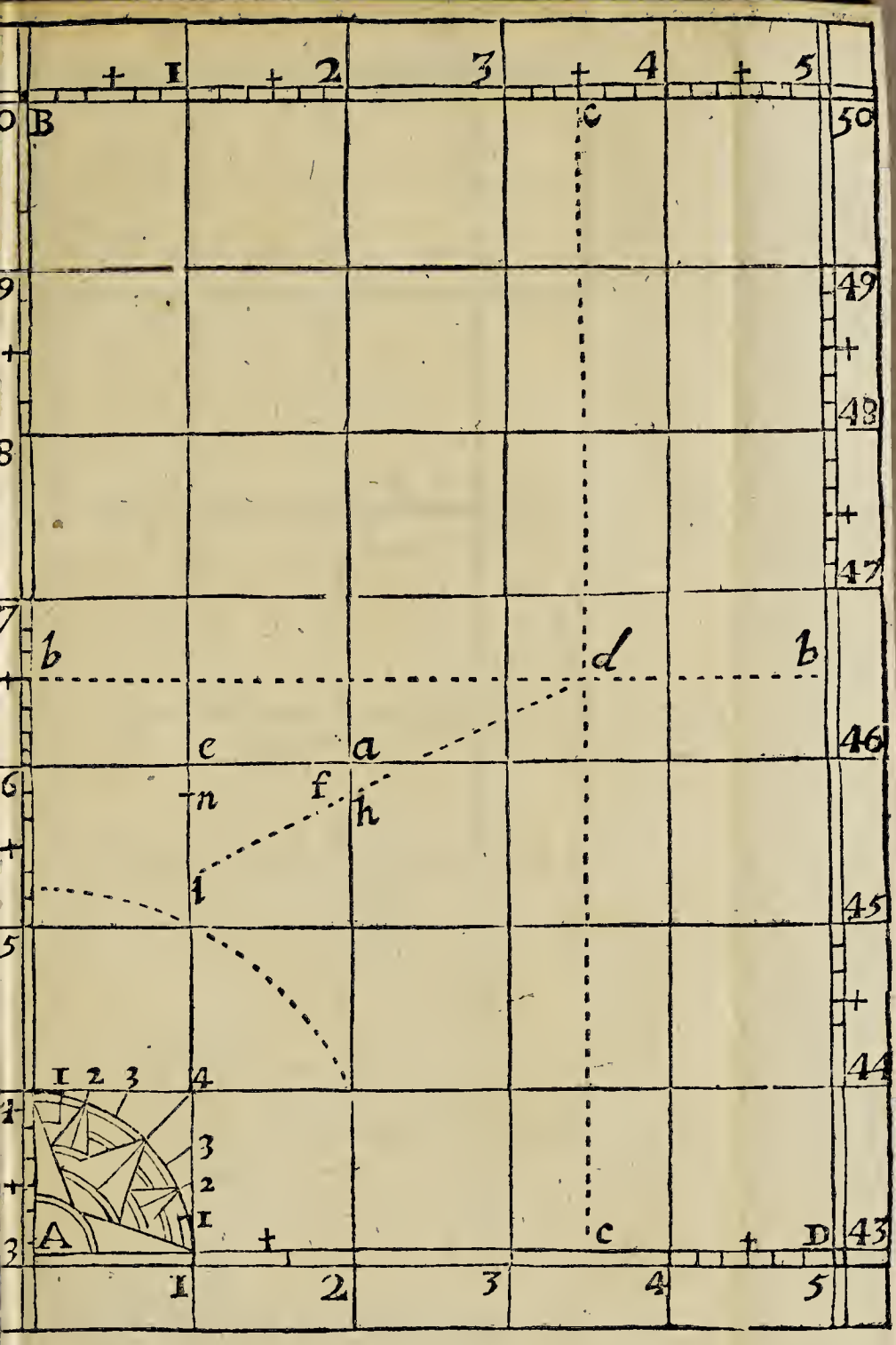
Firſt, laying a Rular over 46 degrees, 30 minutes of the extreme Meridians, draw the Parallel of 46 degrees, 30 minutes, as b b, and laying it over 3 degrees, 30 minutes of the extreme Parallels, draw the Meridian c c, and where this Meridian and Parallel croſs as at d, is the place required.

But if I had been to lay down the place d by a Courſe and Diſtance given: as ſuppoſe I know it ſhould lye N. E. from A, then from A I draw a Parallel to the N. E. Rumb Line, as A d, and taking 5 deg. or 300 m. from the Meridian Line, ſet it from A on the Line A d to d.

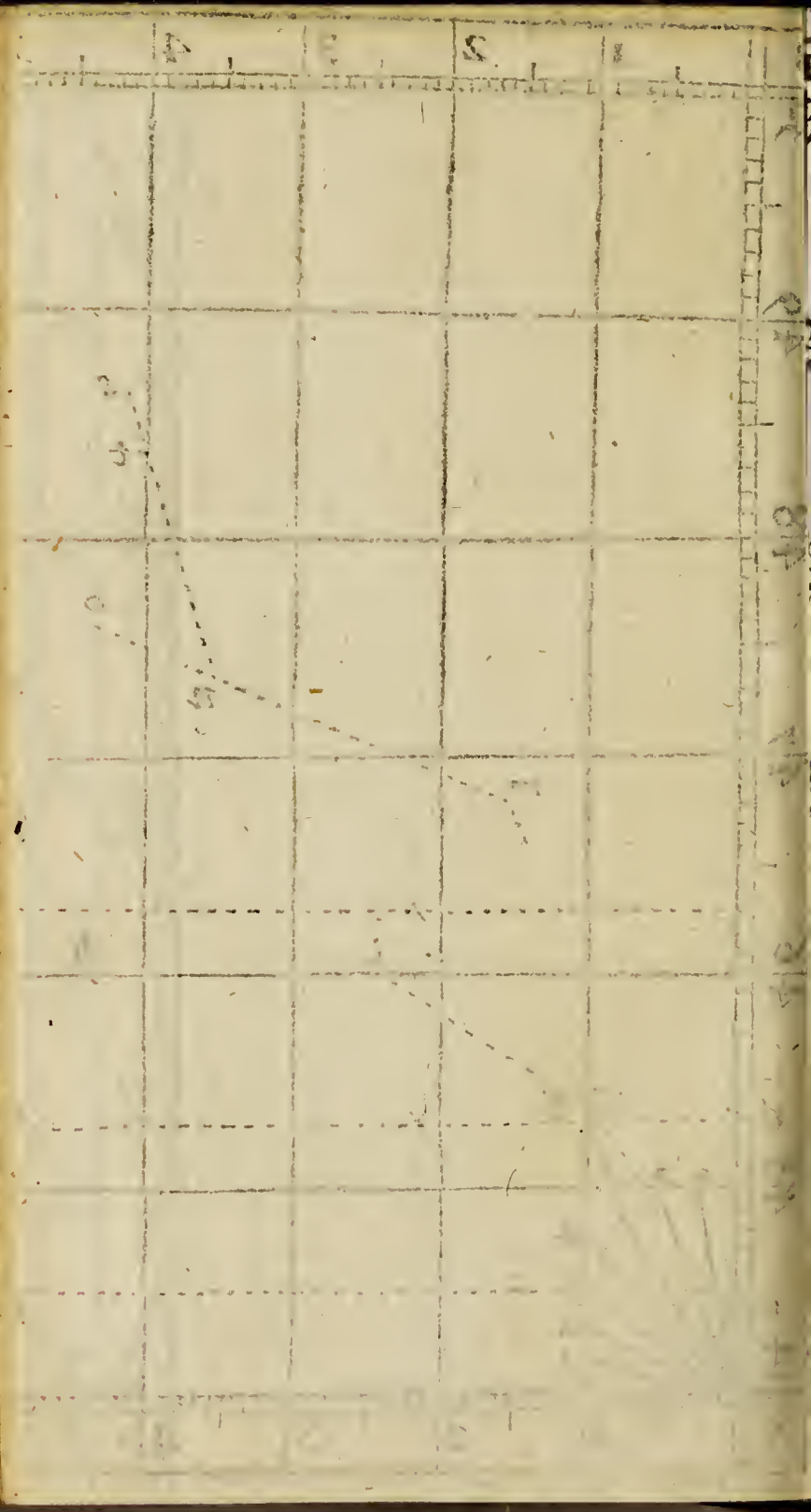
If I had been to lay it down by the Courſe and Latitude by a Rular over 46 deg. 30 min. of the extreme Meridians, I draw the Parallel of Latitude b b, and from A, a Parallel to the North Eaſt Rumb-Line, as A d, and where theſe cut one the other, as at d is the place.

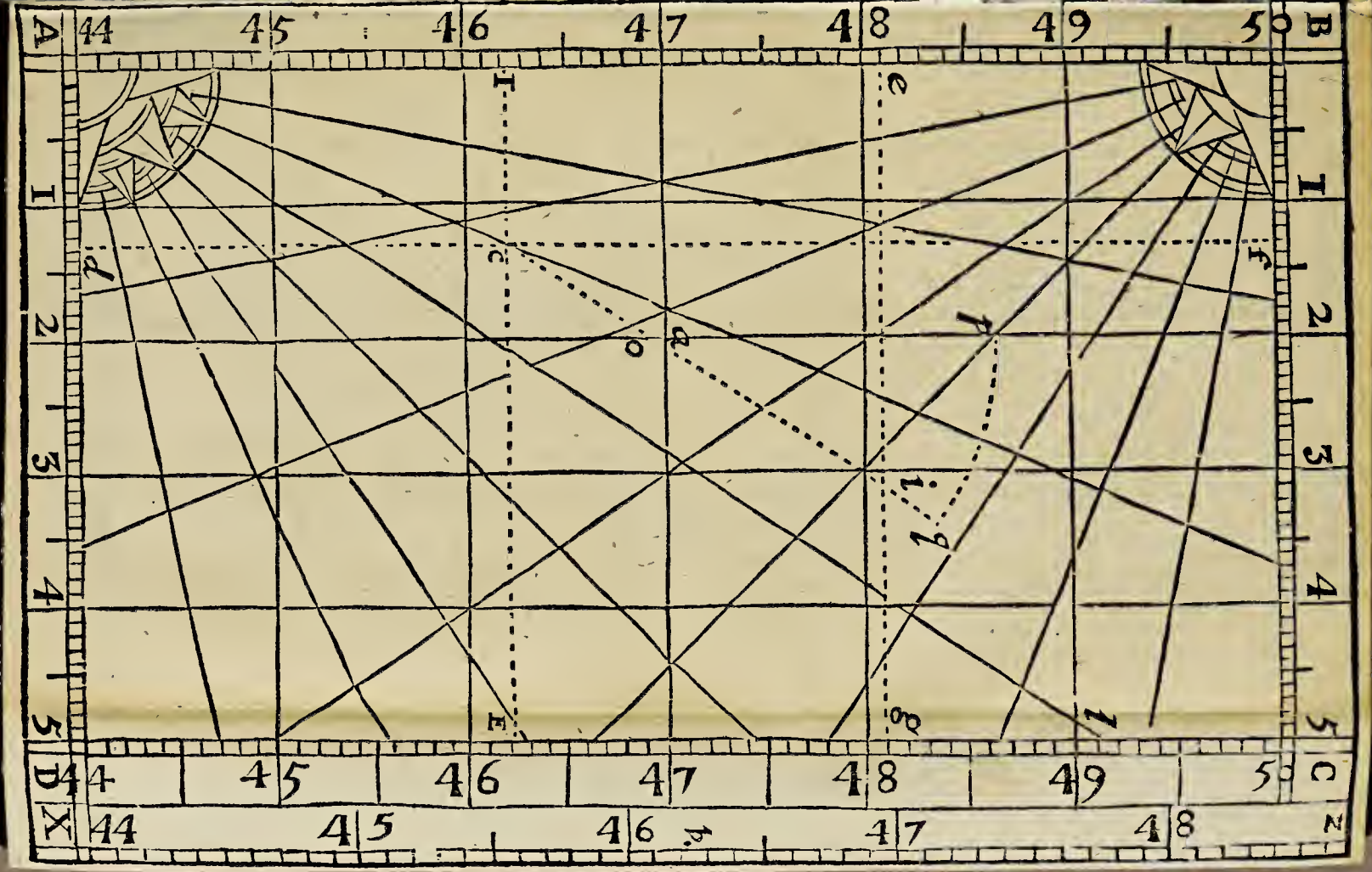
But laſtly, if I had been to lay it down by the Latitude and Diſtance, I muſt have drawn the parallel b b as before, and then taking from the Meridian 6 d. or 300 m. the diſtance,

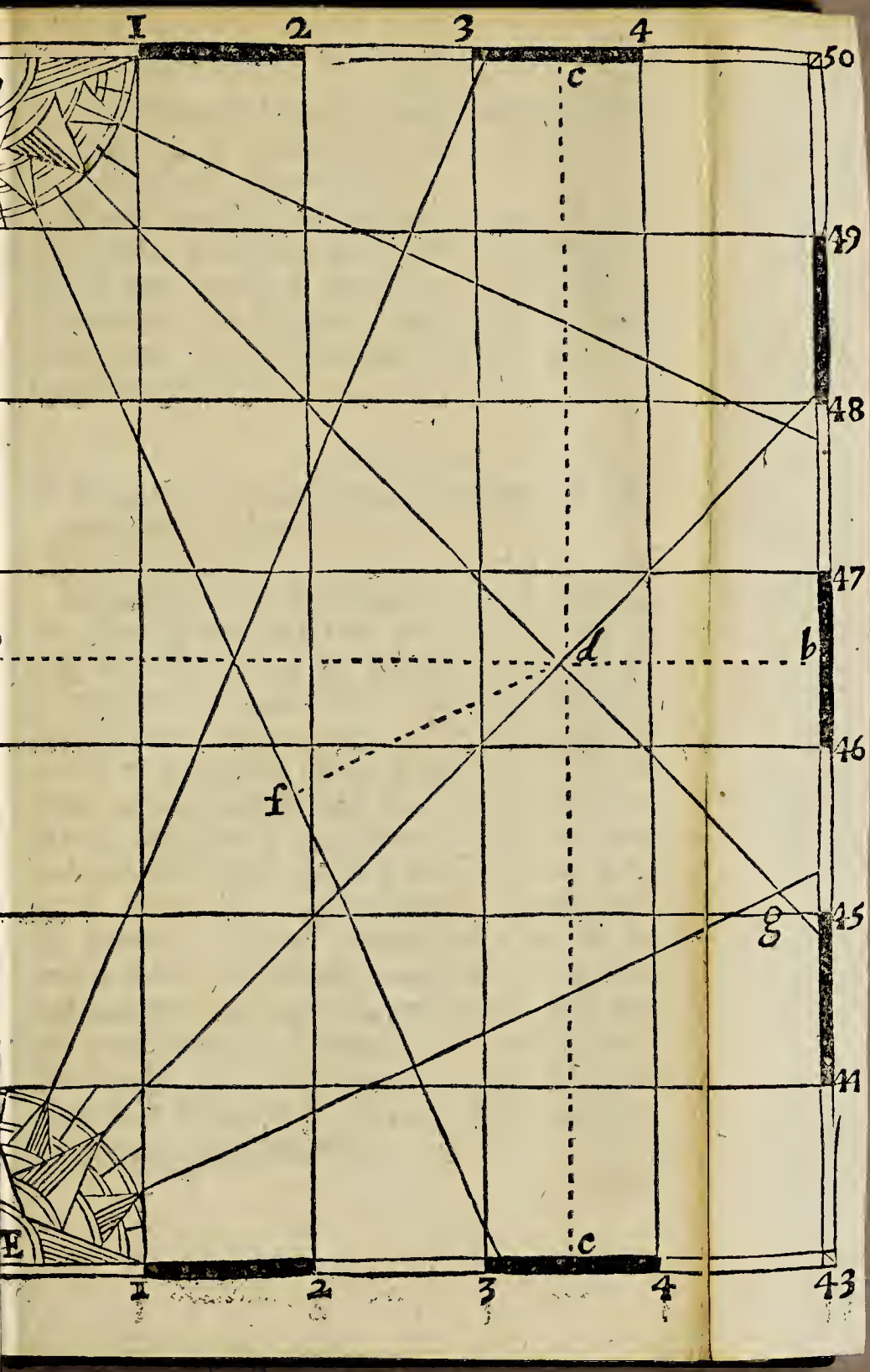
and

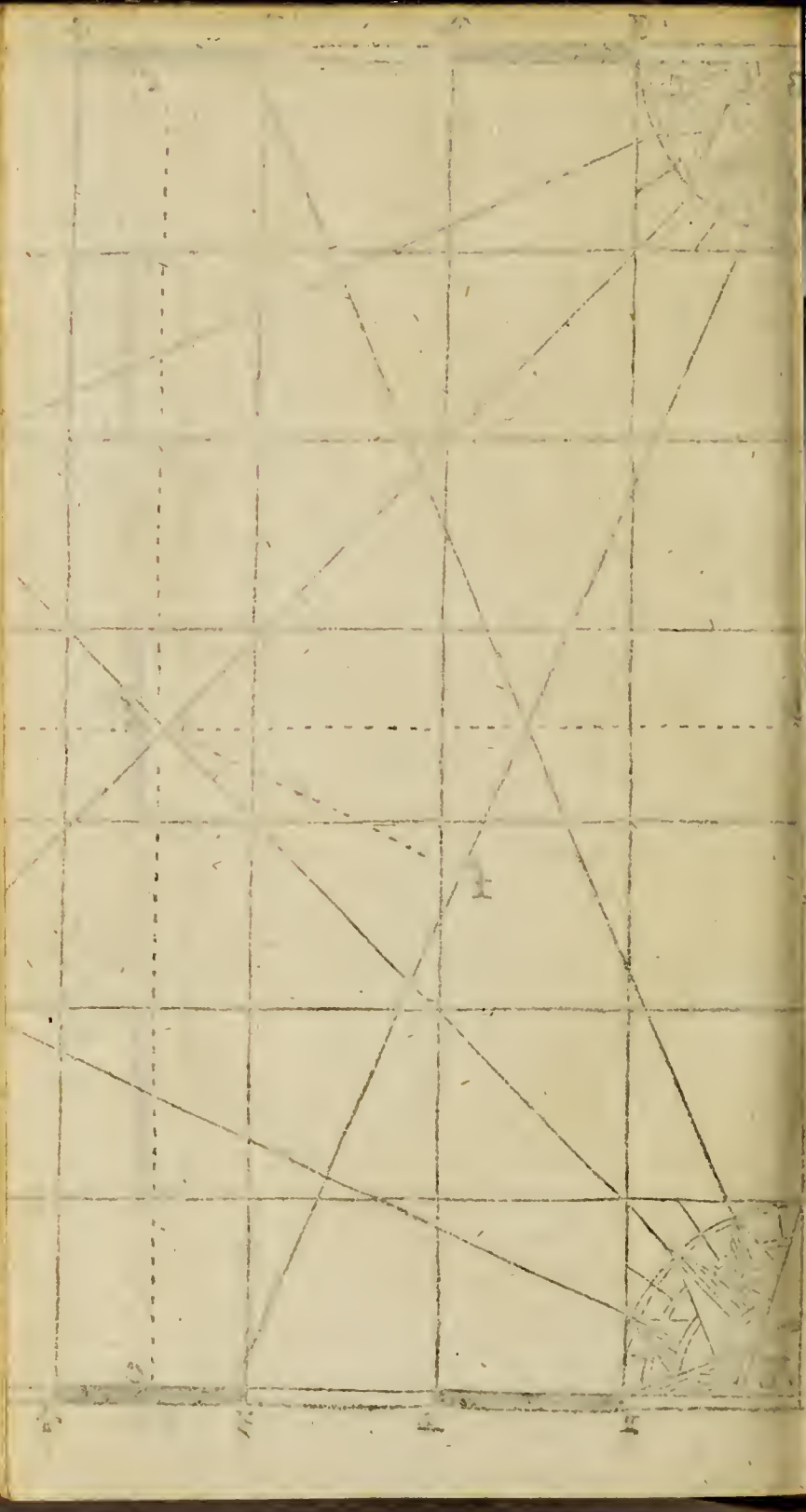

1
2
3
4
5
B
C
50
49
48
47
b
d
b
e
a
46
n
f
h
i
45
44
1 2 3
4
3
2
1
A
c
D
43
1
2
3
4
5

1
2
3
4
5
C
N
50
49
48
47
46
45
44
s
t
o
n
m
q
i
h
g
f
d
e
a
c
b
1
2
3
4
A
I
2
3
4
5
D
X




A
B
C
D
44
45
46
47
48
49
50
I
2
3
4
5
e
f
d
c
o
a
b
g
E
F
X
Z


1
2
3
4
c
50
49
48
47
d
b
46
f
45
g
44
c
43
1
2
3
4



and ſetting one foot in A, with the other make a prick on the parallel b b, as at d, which will be the place propoſed.

If the Rumb-Lines be not drawn on the Chart, you may prick down the Line A d, by ſetting one foot in A, as Center, and with 60 degrees of the Chords, deſcribing a blind Arch, *&c.* after the manner of the firſt and ſecond Caſe of Ch.

To find the Courſe and Diſtance between any two places on the Chart.

Laying a Rular over the two places, as d f, ſee what Rumb-Line runs parallel thereto, as A g, and that ſhews the Courſe, which from d to F is Eaſt North Eaſt. But if the Rumb-Lines be not drawn, only a Compaſs Card depicted on ſome part of the Chart, as in the ſecond draft, then laying the Rular over the places, ſee how it cuts the parallels of Latitude or Meridians, as in h and l, taking a h, ſet it from e to n, and taking n l, apply it to the ſide of the ſquare wherein the Compaſs is, and it ſhews the Courſe, two Points from the Eaſt nearly: then take the extent d f, and apply it to the ſcale, if there be one to the Chart, elſe apply it to the Meridian; and ſo many degrees as it's equal to, ſo many ſcore Leagues are the places diſtant, *&c.*

How

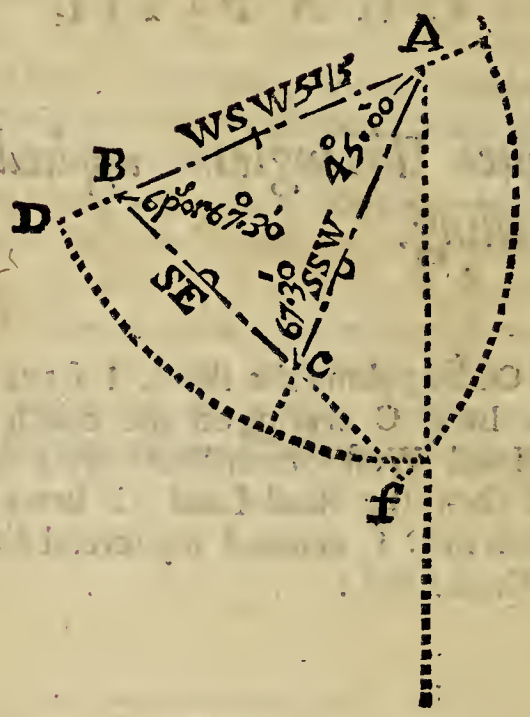
How to prick down a Voyage on the Chart by the Courſe and Diſtance, or make a prick for the ſhips place daily, needs no more inſtructions than what are already given at the beginning of this Ch. where I have delineated the Traverſe. I would adviſe all to keep their Reckoning or Account of the Voyage in number, daily correcting the dead Reckoning, and tabulizing the correct Eaſtings and Weſtings, Northings and Southings in particular Columns; and then if at any time a man be deſirous to make a prick for the ſhips place on his Chart, let him draw a parallel of Latitude, and at Meridian at his true Departure, and where they two cut will be the ſhips place.

CHAP.

CHAP III.

Oblique Triangles applied to Sailing.

1. COasting along the shore, I set an Head-Land C bearing off me South South West, I sail West South West 51·5 miles to B, and then the Head-Land C bears South East from me: I demand my several distances to the Head-Land?



Geometry.

Taking any convenient Point, as A for the place of the ſhip, at firſt from thence draw a South South Weſt Line, as A C, and a Weſt South Weſt Line, as A B, and on A B prick 51·5 m. from A to B. Then ſetting one foot of

of the Compaſſes in B, with 60 degrees of the Chords, deſcribe the Arch e f, and lay thereon ſix points (the Points between Eaſt North Eaſt and South Eaſt) from e to f, drawing B F.

Arithmetick.

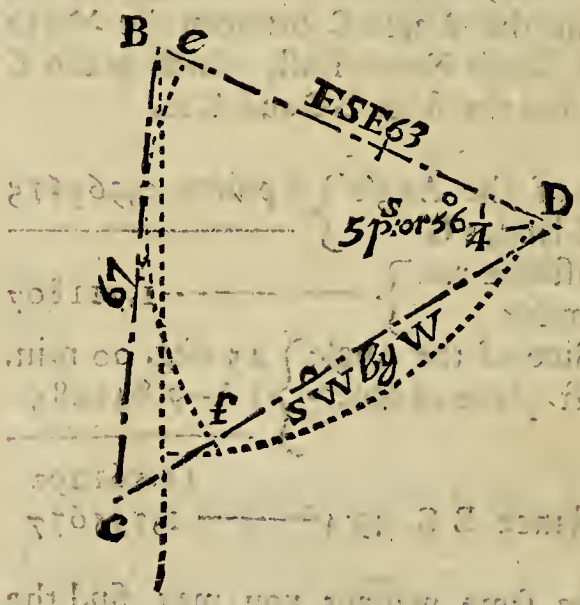
In the Triangle B A C is given the ſide B A 51·5 m. and all the Angles, *viz.* the Angle A, 45 deg. or 4 points between the Weſt South Weſt, and South South Weſt Points, and the Angle B between the Eaſt North Eaſt, and South Eaſt, 6 points, or 67 degrees, 30 minutes, and the Angle C between the North Weſt, and North North Eaſt, which is alſo 6 Points, to find the ſides B C and C A.

As the ſine of the Angle at the Head-land, s C	6 points, 9,965615
Is to the diſtance run A B 51·5 miles.	——————1,711807
So is the Sine of the Angle at the firſt place of obſervation,	45 deg. 00 min. s A--9,849485
	11.561292
To the Diſtance B C 39·4	—— 1,595677

After the ſame manner you may find the Diſtance thereof from the firſt place of Obſervation A, but in this Example for as much as

as the Angles B and C are equal, the ſide A C will be concluded equal to B A 51·5, without another work.

2. *A Ship in the Parallel of* 46 *degrees North, as at* B, *deſcries an Head-Land at* C, *diſtant from her* 67 *miles; ſhe ſails Eaſt South Eaſt* 63 *miles to* D, *and then the Head-Land at* C *bears South weſt by weſt from her: how did the Head-Land bear from the ſhip when ſhe was at* B, *and how far is it diſtant from her now ſhe's at* D?



Geometry.

Taking any convenient point, as B for the place of the ſhip at firſt, from thence draw an Eaſt South Eaſt Line, and prick thereon 63 m. from B to D. Then on D. as Center with 60 degrees of the Chords deſcribe the Arch e f, and prick five points (the points between Weſt North Weſt, and South Weſt by Weſt) from e to f, drawing D f C. Laſtly, take 67 m. in the Compaſſes, and ſetting one foot in B, with the other croſs D C in C, and draw B C.

Arithmetick.

As the Diſtance B C 67 m.---1,826075

Is to the Sine of the Angle D 56 deg. 15 m. } 9,919846
So is the Diſtance ſailed B D 63 m. } 1,799341

11,719187

To the Sine of the Angle C, 51 deg. 26 min. or } 9,893112

4 points and a half, which added to the Angle D, 56 deg. 15 min. and that ſum taken from 180 degrees, the Remainder 72 degrees, 19 minutes, or 6 points and a half is the Angle B, which added to the Eaſt South Eaſt gives the

the bearing off G to be South half Westerly *fere.*

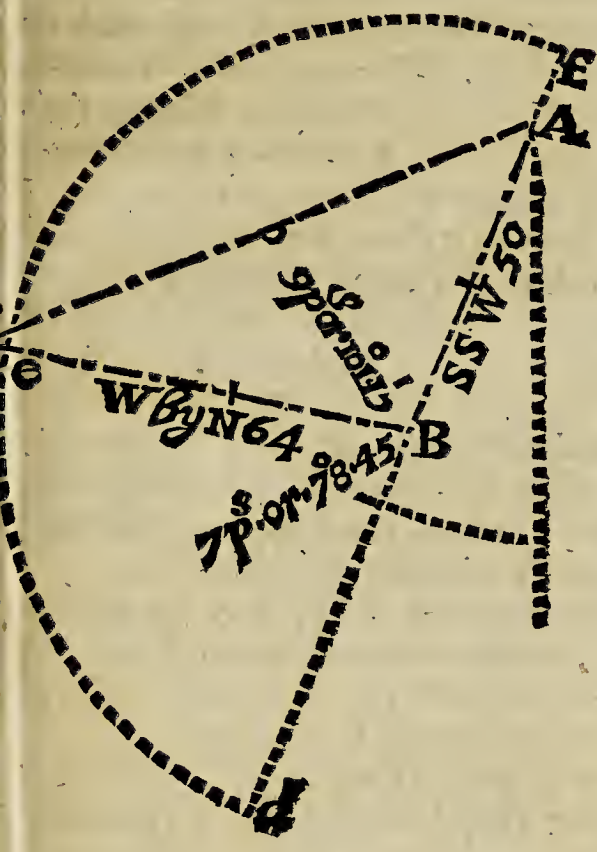
Then as the Sine of the Angle D, 56 degrees; 15 minutes } 9,919846

Is to the Distance BC 67 m.----- 1,826075
So is s Angle B 72 deg.19 m.----- 9,978980

11,805055
To the Distance DC 76·8----- 1,885209

3. *If*

f I sail South South West 50 miles, and then
est by North 64 miles; I demand the Course and
irect Distance from the place of Departure?



Geometry.

From A the Point taken for the ships p
at first, draw the South South West Line,
lay thereon 50 m. from A to B. Then se
one foot of the Compasses in B, with sixty
grees of the Chords describe the semic
d e b, and either prick 7 Points (the P
between South South West, and West
North) from d to e, or 9 Points from f
and through e draw B e, laying thereon 6
from B to C: lastly, draw A C.

Arithmetick.

In the Triangle C B A there's given
two sides C B, and B A, and the conta
Angle, C B A, 9 points, to find the A
A and C, and the third side C A.

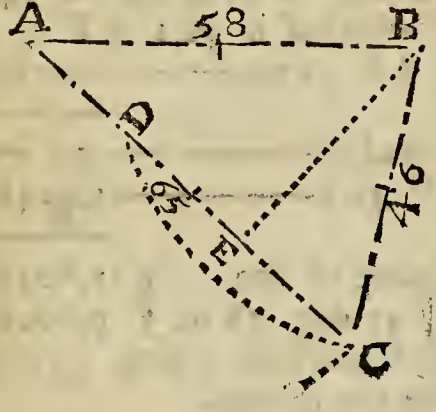
Therefore, as C B + B A 114 m.	2,056905.
Is to C B--B A 14	1,146128
So is t, half Angle C + Angle A, t 39 deg. 23 m.	9,914302
To the Tang. A-C 5 deg. 45 m.	11,060430 / 9,003525
Which subtracted from 39 deg. 23 min.	Ang. C, 33 d. 3

There remains but 5 degrees, 45 m. a
to 39 deg. 23 m. makes 545 deg. 8 m.

e A, wherefore seeing A D is a South
h West Line, A C is West South West
y, *viz.* West South West 8 m. Westerly.
hen for the Distance A C, say

he Sine of the Angle A, }	9,850493
eg. 8 m. ——— }	———
the Dist. B C 64 m. ——	1,806180
the Sine of the Angle B }	9,991574
deg. 15 m. or rather it's }	———
pl.to 180 d. *viz.* 78 d. 45 m. }	11, 797754
he Dist. A C 88·5 m. ——	1,947261

dmit two Ports lying in the same Parallel or
titude, differing in Longitude 58 *miles,*
d a Ship having sailed from the westermost
tween the South and East 65 *miles, be then*
miles from the Eastermost, I demand the
urse she steered, and her Course to the Easter-
ost Port?



Geometry.

Having drawn an East and West and laid thereon 58 m. from A to B, 65 m. in the Compasses, and setting one in A, with the other describe an Arch; wards take 46 m, and setting one foot with the other cross the former Arch Lastly, draw A C, and B C.

Arithmetick.

As A C 65 m. ——— 1,812913

Is to A B + B C 104 —— 2,017033
So is A B-B C 12 ——— 1,079181

To A D 19·2 { 3,096214 / 1,283301
Which added to A C 65 is 84·2
The half whereof is 42·1 A F
Then as A B 58 m. ——— 1,763428

Is to the Radius ——— 10 ———
So is A B 42·1 ——— 1,624282

To the Cosine of the Angle A, 43 deg. 28 m. { 11,624282 / 9,860854
That is South East 1 deg. 32 min. East the Course she steered.

5. Co

ſting along the ſhore, I ſet two Head-Lands, one at C, bearing S.W. by W. the other at bearing W. by W. I ſail away N. W. by N. H, 40 miles, and then the Head-Land at C s S. S. W. and that at D S.W. by S. I de- nd how far theſe Head-Lands are aſunder, and they bear one off the other.

First draw a North and South Line b A g, and with 60 degrees of the Chords ting one foot on some convenient point fo ships place at first, as A, describe the semic b e g, (or a Circle if the Courses requir then prick thereon five points from g to points from g to e, and 3 points from c, and draw A f C, A D e, and A H c, l 40m. from A to H.

Secondly, set one foot of the Comp opened to 60 degrees of the Chords on H, describe the Arch a d, and prick thereon Points (the Points between South Eas South, and South South West) from a and 6 points (being the points betwee S. E. by S. and S. W. by S.) from a and draw H h c, H D d, and D C. Th D one Head-Land, and C the other.

Arithmetick.

In the Triangle H A C, there's give Angle H A C 8 Points (*viz.* the Points tween South West by West, and North by North); the Angle A H C 5 p (between the South East by South, and S South West) and the Angle A C A 3 P (the Points between the North East by and North North East) and the side 40 m. to find the side C H. Therefore,

he Sine of the Angle A 33 deg. 45 min. } 9,744739

o HA 40 m. ——— 1,602060
s the Sine of 90 deg. Angle H A C ——— } 10 ———

11,602060
the side A C 72 m. —— 1,857321

Then in the Triangle D H A there's given Angle H A D 6 Points (*viz.* the Points ween the North West by North, and West South) and the Angle A H D 6 Points *l.* the Points between the South East by th, and South West by South) and the gle H D A 4 Points (between the North t by North, and East by North) and the AH 40 m. to find the side D H. Thus he Sine of the Angle A 45 deg. 00 min. } 9,849485

the side A H 40 m. 1,602060
s the Sine of the Angle D 67 d. 30 m. } 9,965615

11,567675
D H 52·3 ——— 1,718190

Lastly in the Triangle D H C there's given two sides C H 72 m. and D H 52·3 m. their contained Angle C H D 1 Point, to l the other two Angles H D C, H C D, and third side D C.

As HC † HD 124·3 —— 2094471

Is to HC——HD 19·7—— 1,294466
So is the Tang. Angle HDC
† HCD 7 points and a half,
or 84 deg. 22 min —— 11,005955 / 12,300421
To the Tang. Angle HDC
Ang. HCD 58 d. 6 m. 10,205956
Which added to 84 d. 22 m. makes 142 d.
m. the Angle HDC, but ſubſtracted, lea
25 d. 16 m. the Angle HCD, which is No
1-quarter Weſterly, or N. 2 d. 45 m. Weſte
As the Sine of the Angle
HCD 25 d. 16 m. 9,630257

Is to DH 52·3 m. —— 1,718190
So is the Sine of the Angle
DHC 11 d. 15 m. 9,290236

11,008426

To DC 23·9 m. the Diſt.
between the two Head-La. 1,378169

CHA

CHAP IV.

Mercators Sailing.

THo the Plain Chart be very desirable
for it's easiness, and very useful in short
ages, and will serve in the longest Voya-
so a man return in or near the opposite
nb he went by, as the Ancients, who being
sters, did before the use of the Compass.
for as much as few places, or indeed none
such as lye under the same Meridian, or
er the Equinoctial, can be therein expressed
rding to the true situation and distance one
n another: but if they be laid down true
he Course and Distance, the Difference of
gitude will be false, if they be laid down
he Course and Difference of Longitude;
n will the Distance and Difference of La-
de be more than it should be, and if they
aid down by their distance and difference
Longitude, which in many Cases is impossi-
the Difference of Latitude will always be
little, and the Rumb too wide from the
idian; and if they be laid down by their

Latitudes and Separation, then the Co
will be wide, and the diſtance too much,
and the places in particular Maps or Ch
being laid down in ſome one way, and i
thers another, and theſe Pieces many ti
tack'd together without due conſideration of
differing methods places have been laid d
by, the Geography and Hydrography of
World is ſo corrupted, that there are ſc
extant any Deſcriptions of the whole, or l
parts that are not notoriouſly erroneous,
the ſhape of the Lands much diſtorted:
were to be wiſhed, that the world would
put over-much value thereon, nor uſe it in
laying down places, but by degrees, as m
as may be, wean it ſelf from the uſ
the Plain Chart, and by making the true C
eaſie and familiar, bring it in requeſt and
ſeeing there is ſuch a thing.

It was the great ſtudy of our Predeceſſor
contrive ſuch a Chart in *Plano* with ſtrai
Lines, on which all, or any parts of the W
might be truly ſet down according to t
Longitudes, Latitudes, Bearings and Diſtan
a way was hinted almoſt two thouſand y
ſince by *Ptolomy*, and a general Map accord
thereto made in our preceding Age by *Me*
tor (whence it's called *Mercator*'s Chart)
the thing demonſtrated, and a ready
ſhewed of deſcribing it, was not till Mr. *Wr*
about a hundred years ſince taught to inl

Meridian Line by the continual addition of
ants, so that all the degrees of Latitude
ht be proportional to those of Longitude,
n the Globe, which he has done after such
excellent manner, that in many respects it's
more convenient for the Navigators use
n the Globe it self, and will truly shew the
rse and Distance from place to place,
ch way soever a ship sails forth, or re-
ns.

shall shew to inlarge the Latitude both by
Meridional Parts and Artificial Tangents a-
e 45 d. accounting every 30 m. to be one
. and every minute to be two minutes of
Meridian Line, *&c.* which are in the same
o, or hold the same proportion as the Me-
ional Parts made by the addition of Se-
ts.

*find the Meridional Leagues or Minutes, an-
wering to any Difference of Latitude. First by
he Table of Meridional Parts.*

Look the degrees of either Latitude by the
t Side, and the Minutes over head, and in
Angle of Meeting are the parts for that
itude; so also look out the parts for the
er; then if both Latitudes be of the same
ne, that is, both North, or both South, sub-
& these one from the other, and the Re-
inders are the Meridional miles, or minutes
sought.

ſought. But if there be minutes above tens, add a proportionable part of the difference which you find right againſt in the Right Hand Column under D.

	Mer. Parts.
Let one Lat. be 50 d. 20 m. N.	3505
And the other Lat. be 43 d. 15 m. N. which gives 287 6/70	2883
	622

The Meridional Miles between theſe two Latitudes: which, if divided by 3, gives Meridional Leagues.

To find the Parts by the Table of Tangents.

Take half each of the given Latitudes, and to each half add 45 degrees, looking the Tangents of theſe Arks in the Table of Tangents, the difference of which Tangents divide by 379, and the Quotient ſhall be the Meridional Leagues required, or by 126·3, and the Quotient ſhall be Merid. Minutes, or Miles.

Thus the half of 50 deg. 20 m. is 25 d. 10 m. which added to 45 deg. makes 70 deg. 10 min. the Tang. 4428

wher

whereof is the half of 43 d. 15 m. is 21 d. 37 m. and a half, which added to 45 d. makes 66 d. 37 m. and a half, the Tangent whereof omitting the Caracteriſt. is ——— 364294

379

The Merid. Leagues 207·3 as before.

78585
758

2785
2653

1320
1137

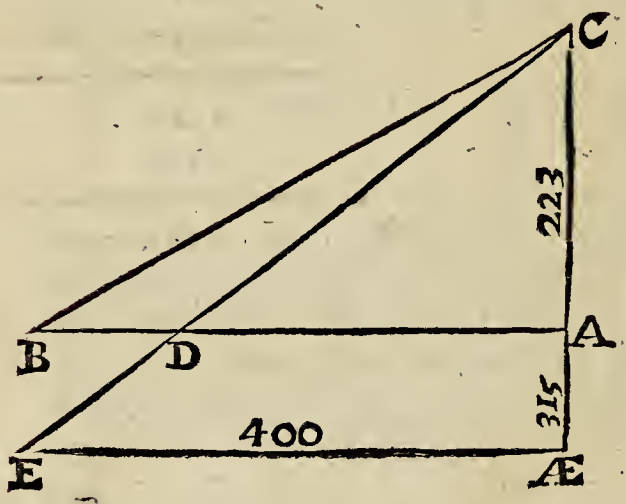
182

CASE

CASE I.

The Latitudes and Difference of Longitudes of two Places given to find the Course and Distance.

Admit the Course and Distance between the *Lizard* in Lat. 50 deg. 10 min. and *Flores* (one of the *Azores* Isles in Lat. 39 deg. 00 min. N. whose difference of Longitude is 20 deg. be required.



Geometry.

Geometry.

Having drawn the Meridian Æ C, and laid 315 Leagues the Diff. Lat. inlarged from Æ to C, and on Æ raiſed a Perpendicular, prick 400 Leagues the Diff. of Long. from Æ to E, and dtaw C E, then prick 223 Leagues, the true Diff. Lat. from C to A, alſo on A raiſe a Perpendicular, as A B, pricking thereon 400 Leagues from A to B, and draw C B.

Then is C the *Lizard*, B *Flores*, according to the Plain Chart, E *Flores* according to the true Chart, C B the Diſtance between them on the Plain Chart, C E the inlarged Diſtance, and C D the true Diſtance, C B the Rumb-Line between them according to the plain Chart; C E the true Rumb-Line. B C A is the Courſe according to the Plain Chart, and E C Æ the true *Mercator* Courſe, E Æ is the true Difference of Longitude, A D the true Meridian Diſtance or Departure.

Arithmetick.

Lat. 50 deg. 10 min.
Lat. 39 deg. 00 min.

The

The half is

25 deg. 5 min.
19 deg. 30 min.

Which added to 45 deg. makes

70 deg. 5 min.	The Tangents are	440903
64 deg. 30 min.		321504

379) 119399
1137

Diff. 315 Leagues ——— 569
The Lat. inlarged, C Æ. ——— 379

1909
1895

14

As the Difference of Latitude inlarged, C Æ 315 Leagues	2,498311
Is to the Radius ———	10, ———
So is the Difference of Longitude E Æ 400 Leagues ——	2,602060
To the Tangent of the true Course t Angle ECÆ 51d.46m.	10,103749

Which sheweth the Course from the *Lizard* to *Flores* to be S. W. 6 degrees, 46 min. Westerly

Westerly, or from *Flores* to the *Lizard* North East 6 degrees, 46 minutes Easterly: but by measuring the Angle B C Æ you'll find the Course according to the Plain Chart South West about a quarter Westerly.

For the Distance.

As the Sine Compl. of the Course Cos. Ang. E C Æ, 51 deg. 46 m. } 9,791596

Is to the Diff. of Lat. C A 223 Leagues } —— 2,348505
So is the Radius —— 10,

12,348505

To the true distance on the Rumb CD——360·5 Leag. } 2,556909

But by measuring B C you'll find the distance according to the Plain Chart 435, so that the Plain Chart sheweth the distance more than it is by 75 Leagues, and the Course more Westerly than the truth, by above half a point, and the Departure a great deal too much.

By the Gunter.

Set one foot of the Compasses in 315 on the Line of Numbers, and extend the other to 400; then keeping the same extent, set one

one foot on the Tangent of 45 deg. turning the other forward, and it will fall on 51 deg. 46 min. the Courſe.

For the Diſtance.

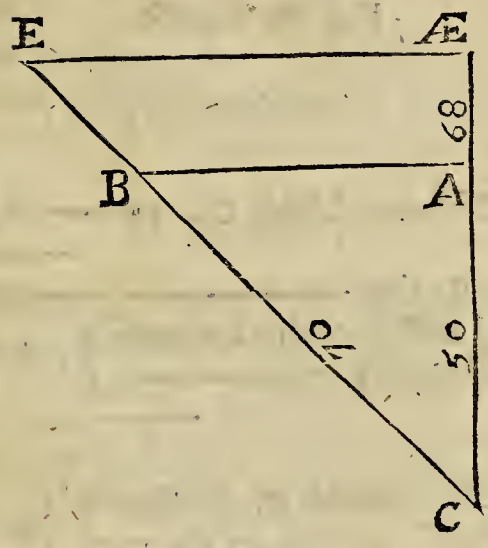
Set one foot in 38 deg. 14 min. of the Line of Sines, and extend the other to the Sine of ninety degrees, then keeping the ſame extent, ſet one foot in 223 of the Line of Numbers, and turn the other forward, and it will fall on 360 the Diſtance on the Rumb; there is a nearer paſſage between theſe two places, which is by the Arch of a great Circle.

This Propoſition is firſt of uſe in a Voyage.

CASE II.

The Latitudes of two Places, and their Diſtance given: to find the Courſe and Difference of Longitude.

A ſhip from the Latitude 41 deg. 30 m. N. ſails North Weſtward 30 Leagues, till ſhe be in the Lat. 44 deg. 00 min. which was her Courſe and Difference of Longitude.



Geometry.

First, with the Difference of Latitude, and Distance given, delineate according to the third Case of Plain Sailing, then produce the Meridian and Rumb-Line, and lay 68 the Difference of Latitude inlarged from C to Æ. Lastly, through Æ draw Æ E parallel to A B.

For the Course.

Arithmetick.

As the Distance sailed, CB 70—— 1,845098

Is to the Radius———————— 10,——
So is the Differ. of the Latitude
C A 50 Leagues ———— } 1,698970

11,698970

To the Sine Compl. of the Course
Cos. Ang. C. 44 deg. 25 m. —— } 9, 853872
That is North West, 35 min. Northerly.

For the Difference of Longitude.

First, find either by the Table of Merid. Parts, or the Tangents, the Meridional Leagues in the Difference of Lat. which are here 68 : Then say,

As the Radius———————— 10, ————
Is to the Diff. of Lat. inlarged
C Æ 68 Leagues ———— } 1,832509
So is the Tangent of the Course
t Ang. C 44 deg. 25 m. } 9, 991156

11,823665

To

To the difference of Longitude in Leagues Æ E 66·6.

Which Leagues being multiplied by 3, and the Product divided by 60, give 3 deg. 20 m. the Difference of Longitude, required.

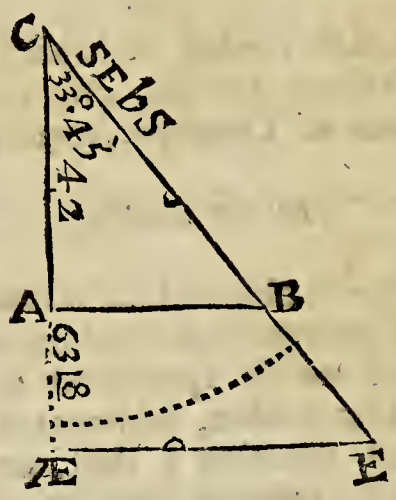
By the Gunter.

He that hath well observed the manner of working all along hitherto by the Gunter, I cannot but suppose, will readily apprehend the working thereby of what follows, without any more Directions, and therefore I shall omit farther precepts for it, unless in some few useful Cases.

CASE III.

Both Latitudes and the Course being given, to find the Distance and Difference of Longitude.

A ship from the Latitude 50 deg. 00 min. North. sails South East by South till she be in the Latitude 47 degrees, 54 minutes North, what will be her Distance run, and the Difference of Longitude?



Geometry.

Having drawn a Merid. Line C Æ. described an Arch, lay'd thereon the Course, drawn the Rumb-Line C Æ, and raised the Perpendicular B A according to the second Case of Plain Sailing, inlarge the Latitude, and lay the Difference of Latitude inlarged 63·8 from C to Æ, and on Æ raise the Perpendicular Æ E.

For

For the Distance.

Arithmetick.

As the Cos. of the Course Ang. C 33 deg. 45 min.	9,919846
Is to the Diff. of Lat. CA 42 1	1,623249
So is the Radius	10,——
	11,623249
To the Distance CB 50·5 1	1,703403

For the Difference of Longitude.

As the Radius	10,——
Is to the Diff. of Lat. inlarged C Æ 63·8 Leagues.	1,804821
So is the Tang. of the Course Ang. C 33 deg. 45 min.	9,82489
	11,62971
To the Diff. of Long. ÆE 42·6 Leagues.	

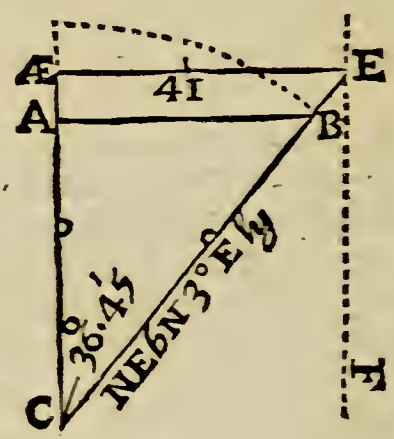
By these two Canons was made the third Traverse Table, which readily performs what's required in this Proposition.

CASE

CASE IV.

One Latitude, the Course and Distance of Longitude, being given, to find the other Latitude and the Distance.

Admit a ship sail from Latitude 32 deg.00 m. North, North East by North, 3 degrees Easterly, till she has altered her Longitude 2 degrees, 3 minutes, how much shall she have raised the Pole, and what is her distance sailed?



Geometry.

Having drawn the Meridian C Æ, described an Arch, pricked thereon the Course, and drawn

vn the Rumb-Line C E, at the extent 41
he equal parts, or Leagues, draw a paral-
o the Meridian C Æ as F E; and from
point E let fall a Perpendicular to C Æ,
Æ; then add to the measure of C Æ
the difference of Latitude inlarged, the
idional Leagues for 32 deg. 00 min. of
ude, and the triple Sum looked in the
e of Meridional Parts, gives 34 deg. 22
the Latitude she's arrived in: Lastly,
ract these Latitudes one from the other,
the difference turned into Leagues, prick
C to A, through A, drawing A B parallel
E E

For the Difference of Latitude.
Arithmetick.

the Tangent of the Compl. Ang. C 36 d. 49 m.	9,873167
the difference of Lat. E Æ 41 Leag.	1,612784
the Radius	10
	11,612784
he Diff. of Lat. inlarged 54·6 Leagues	1,739617
Merid. Leagues answering deg. 00 min. of Lat. are	676·0
which add.	54.0
Sum	730·9
Triple	21927

M Against

Againſt which in the Table of Meridi
Parts is Lat. 34 deg. 22 min.

For the Diſtance.

As the Coſine of the Courſe 36 deg. 45 min. } 9,90377

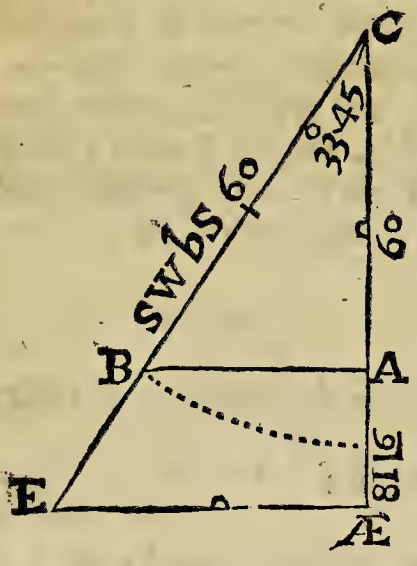
Is to the true diff. of Lat CA 47·3 Leagues } 1,67486
So is the Radius — 10

11,674861

To the diſtance CB 59 — 1,771091

CASE V.

Course and Distance and one Latitude being given, to find the other Latitude and the difference of Longitude.



Geometry.

Ship from Latitude 53 degrees, 30 minutes North, sails South West by South 60 miles, I demand the Latitude she's in, and the Difference of Longitude. I protract the

Course and Distance according to Case I
Plain Sailing and measuring the Differenc
Latitude C A, I find it 49·9 Leagues, w
I convert into degrees, by dividing by
This 2 deg. 30 min. the difference of I
tude, because she depresses the Pole, I
stract from Lat. 53 deg. 30 min, and the
mainder 51 deg. 00 min. is the Latitude
arrived in. Then either by the Table of
ridional Parts, or that of Tangents, I find
inlarged Difference of Latitude, as form
directed, and prick that, *viz.* 81·6 from
Æ. Lastly, on Æ I raise a Perpendicula
C Æ as Æ E, and produce the Rumb-
C B till it meets with Æ E.

Arithmetick.

For the Difference of Latitude.

As the Radius	10	
Is to the Distance sailed C B 60 Leagues.	1,7781	
So is the Cosine of the Course Angle C, 33 deg. 45 min.	9,9198	
	11,6979	
To the Difference of Latitude C A 49·9 Leagues.	1 6979	

converted into degrees, is 2 deg. 30 *ferè*, the Difference of Latitude, which acted from 53 deg. 30 min, leaves 51 00 min. the Latitude required. The ence of which two Latitudes inlarged is Leagues.

For the Difference of Longitude.

e Radius ——— 10 ———	
ference of Latit. inlarged 81·6 ———	1,911690
the Tangent of the Course gle C 33 deg. 45 min.	9,824892
	11,736582
e Difference of Longit. 54·5 Leagues, which ed by 20, or multiplied	1,736582

y 3, and then divided by 60, makes 2 43 min. and a half.

By the Gunter.

For the Difference of Latitude.

one foot in the Sine of 90 deg. and ex- he other to the Sine of 56 deg. 15 min. keeping the same extent, set one foot in n the Line of Numbers, and the other

turned backward, will fall on 49·9 Lea
the Difference of Latitude, which conv
into degrees, is 2 deg. 30 min. which 2
30 min. becauſe ſhe depreſſes the Pole,
ſtract from 53 deg. 30 min. and the Re
der 51 deg. 00 min is. the Latitude the ſ
in. The Difference of which two Lati
inlarged is 81·6.

For the Difference of Longitude.

Set one foot of the Compaſſes in the
gent of 45 deg. 00 min, and extend the
to the Tangent of 33 degrees, 45 min
then keeping the ſame extent, ſet one fo
81·6 on the Line of Numbers, and tur
other foot backward, and it will fall on
Leagues, the Difference of Longitude.

There be ſeveral other Propoſitions of
tator's Sailing : as

6. *By the one Latitude, Diſtance, Rumb
Departure, to find the Courſe, Latitude the S
in, and the Difference of Longitude.*

7. *By the Departure and both Latitudes g
to find the Diſtance run, Difference of Long
and Courſe.*

8. *The Courſe, one Latitude, and the Dep
given, to find the Diſtance, Difference of
tude, and Difference of Longitude.*

But theſe being of no great uſe, I ſh
mit them, and inſert two or three Pr

s of Sailing, under a Parallel of Latitude.

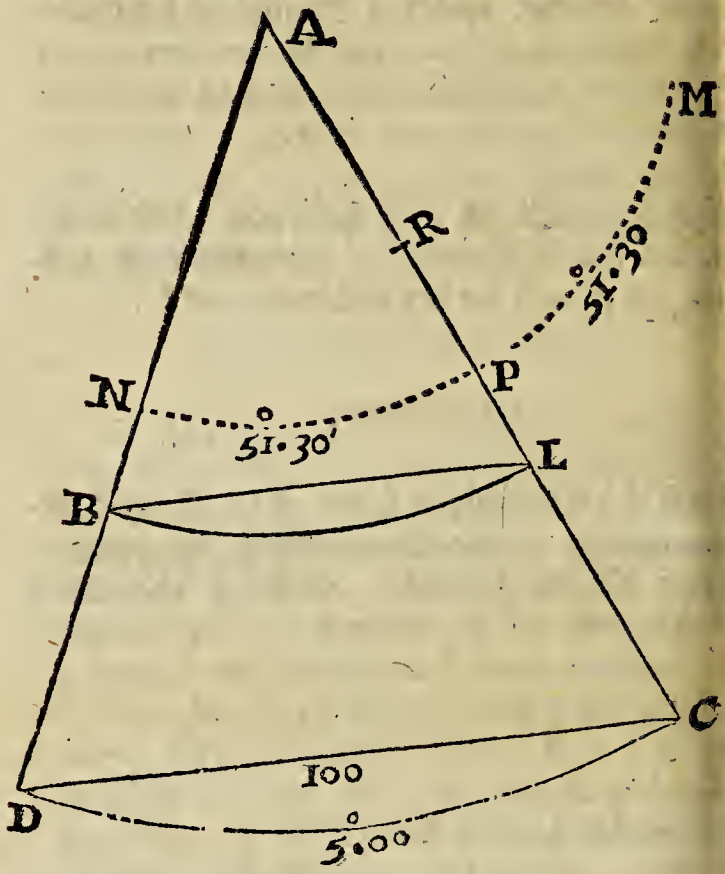
he Difference of Longitude between two places ith in one Parallel or Latitude being given, to ind the Distance between them.

f a Ship sail in the Latitude 51 deg. 30 r. till her Difference of Longitude be 5 d. n. what will be her distance run?

Geometry.

First draw a straight Line, as A C, and set- g one foot of the Compasses in A, with 60 grees of the Chords, describe the Arch ? M, and prick thereon 51 deg. 30 min. Latitude from P both ways to N and M; n laying a Rular from M to N, cross the ne A P in R; afterwards prick A R from R L, that is, double A R, and also A P, and scribe the Arches L B, C D.

Lastly, taking 100 Leagues from the Line equal parts, prick it from C to D, and w C D, and D A and B L: then is A the le, A C and A D two Meridians, D C an rch of the Equinoctial, B L an Arch of the rallel of 51 deg. 30 min. Lat. A R is the sine of the Latitude, A L=A R doubled, C=A P doubled. A R and A P are doubled t of necessity: for the hundred Leagues



Difference of Longitude might have be
layed on the Arch P N, and the Distance m
sured by an Arch described in A R; but
conveniency that our Line of equal parts mig
serve, without doubling, halving, or takin
new Line.

Arithmeti

Arithmetick.

the Radius or Sine of 90 } 10
. A C ——— }

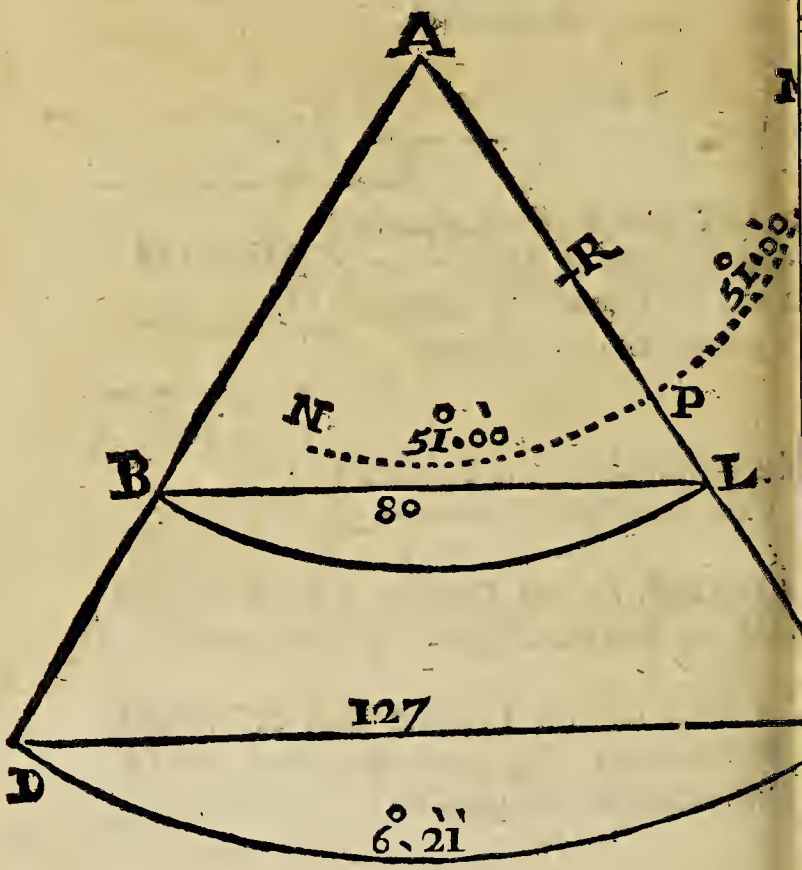
the Cosine of the Latitude } 9,794149
deg. 30 min. A L ——— }
s the Difference of Longit. } 2,000000
5 deg. or 100 Leagues }

11,794149

he Distance in the Parallel } 1,794149
62·3 Leagues. ——— }

Distance in any Parallel of Latitude being iven, to find the Difference of Longitude.

a Ship sail 80 Leagues East or West in Latitude 51 deg. 00 min. what will be Difference of Longitude ?



Geometry.

Having drawn the Meridian A C, and
60 degrees of the Chords described the
N M, and pricked the Latitude from P
ways to N and M, made the mark R, dou
A R, and A P, and described the Arches

L B, as in the laſt Propoſition; take 80 gues from the Line of equal parts, and prick L to B, and draw B L and D C.

Arithmetick.

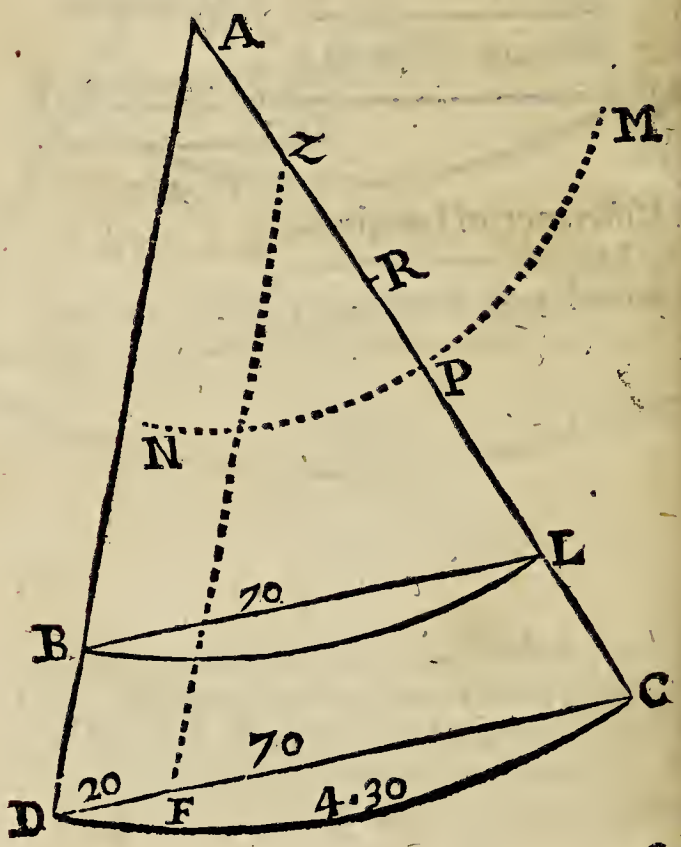
he Coſine of the Latitude leg. 00 min A L	9,798872
the Radius or Sine of 90 A C	10,000000
s the Diſtance ſailed B L Leagues	1,903090
	11,903090
he Difference of Longitude 127 Leagues	2,104218

ch turned into degrees, is 6 deg. 21 min.

3. To

3. *The Distance sailed under any Parallel, and Difference of Longitude being given, to find Parallel or Latitude.*

If a ship sail East or West 70 Leagu and thereby make her Difference of Lon tude 4 deg. 30 min. what is the Parallel or titude she has sailed under?



Geome

Geometry.

Having drawn the Meridian A C, and with 60 degrees of the Chords described the Arch N M, and with A C (the double of A P) described the Arch D C, and laid 90 Leagues the Difference of Longitude, from C to D, and drawn D C, A D, prick 70 Leagues, the Distance on C D from C to F, and through F draw a parallel to D A, as F Z, then with Z C as Radius setting one foot of the Compasses in A, with the other describe the Arch B L: Lastly, bisect A L with a Line at right Angles thereto, as N M; then is the Arch P N or P M cut off by this Line, equal to the Latitude.

Arithmetick.

As the part of the Equinoctial C D 90 Leagues, the Difference of Longitude ——— } 1,954242

Is to the Semidiameter of the Equinoctial C A the R or s. 90 deg. ——— } 10, ———

So

So is that part of the Parallel L B 70 Leagues, the Distance sailed — 1,845098

11,845098

To the Semidiameter of the Parallel A B, the Cosine of the Latitude — 9,890856

And the Latitude is 38 deg. 57 min.

There be several other of this kind, as

Admit two ships under the Equinoctial, and 100 Leagues distant asunder, and they sail both directly North 550 Leagues, how far will they then be asunder?

Two ships in Latitude 50 degrees, 40 minutes North, distant 50 Leagues one from the other, and they sail both directly North 700 Leagues, it's required how far they shall be then distant asunder both in degrees of Longitude and Leagues.

CHAP.

CHAP V.

To make a Mercators Chart.

THe Chart may be made either general for the whole World, or particular, for ſome certain part thereof.

He that underſtands the making of the one cannot be ignorant how to proceed for the other: therefore I ſhall only ſhew, *To deſcribe a Particular Chart* for ſome certain numbers of Degrees of Longitude and Latitude, more or leſs, according as a Voyage ſhall require.

Let it be required to graduate a Chart for a Voyage between the Parallels of 44 deg. and 50 min. of Latitude, and to contain 5 min. of Longitude.

Firſt, draw the North and South Line A B, and croſs it at right Angles in the point A with another right Line A D, repreſenting the Parallel of 44 Degrees. Then taking 60 from any Line of equal parts, or Diagonal Scale, prick it on A D five times from A to D, for the five Degrees of Longitude, marking them 1, 2, 3, &c. as in the Draft, ſubdividing each of theſe Degrees into ten equal parts, which will

will be six minutes each, and afterwards through A draw A B parallel to D C.

Secondly, look in the Table of Meridional Parts, for the parts answering to both Latitudes,

Against { 50 deg. / 44 deg. } are { 3474 / 2945 }
529 the dif.

The difference of these Numbers answering to both Latitudes, *viz.* 52·9 miles, take from the Diagonal Scale, and prick on the Meridians from A to B, and from D to C, and draw B C the Parallel of 50 degrees of Latitude; so are both the extreme Meridians and Parallels drawn.

Thirdly, through 1, 2, 3, 4, *&c.* of the Line A D draw parallels to A B, which will be the Meridians of the Chart. Now if you have a Meridian Line answerable to the equal parts used, as there is on the Gunter's Scale, it's but transferring the Divisions thereof to the Meridian A B, either by laying the edge of the Scale that has the Meridian Line graduated on, to the Meridian A B, or taking them with the Compasses, *&c.* and through these points 45 deg. 46 deg. 47 deg. *&c.* of the Meridian A B, drawing parallels to A D, and the Chart's completely graduated.

Else taking out of the Table of Meridional Parts

Parts the Numbers for Latitude 44 deg. and any other grad. you have a mind to prick down, and ſubſtract them one from the other, and the Difference taken from the Diagonal Scale, lay from A upwards.

Thus the parts for { 47 deg. / 44 deg. } are { 3202 / 2945 / 257 Diff.

The Difference 257 prick from A to 47 deg. ſo proceeding for the reſt, even the ſubdiviſions alſo.

If the two extreme Latitudes be one South, and the other North, and not both in one Hemiſphere, then add the Meridional Parts of both Latitudes together, and the ſum pricked on the North and South Line gives the length of the Chart. You may deſcribe a Compaſs in ſome convenient place, and draw the Rumb-Lines as in the firſt draught.

Laſtly on the outſide of D C make another Line of equal parts XZ, whereof each degree may be twice as large as a degree of Longitude, and divide and graduate it, as you ſee in the Draught: I ſhall call this Line the *Aſſiſtant.*

Sometimes you muſt uſe the Line AD as a Line of Leagues, and then will this *Aſſiſtant Line* be of uſe, and not elſe.

To lay down a place, or make a prick on the Chart.

To lay down a place by the Courſe and Diſtance.

Admit you have ſailed from A, a place in Latitude 44 deg. North, 48 Leagues North North-Weſt, and it be required, to prick the place the ſhip is in.

Take 48 Leagues out of the Line of Longitudes A D, and enter it on the ſecond Rumb, or North North Weſt Line from A to a, the neareſt Diſtance from a to AD prick in the *Aſſiſtant-Line* from X to b, and it ſhews that the ſhip is now in Latitude 46 deg. 14 min. to which Latitude look on the Meridian AB, ſet the Letter I.

Secondly, through the point I draw the parallel of Latitude IE, and where that cuts the Rumb Line, as at c, is the place the ſhip is in.

To lay down a place by its Latitude and Longitude.

Draw a *Meridian-Line* at the Longitude of the place given, and a parallel of Latitude at the Latitude given, and the point where this Meridian and Parallel croſs, or cut, is the prick repreſenting the place.

By

By the Course and Latitude to lay down a place, or make a prick.

Admit from G a place in Latitude 46 deg. 4 min. I sail North West by North, till I am in Latitude 48 deg. 6 min. and would prick the place of the ship. Through 48 deg. 6 m. I draw the parallel of Latitude e g, and through C I draw a parallel to the North West by North Rumb Line, as c i, and where that cuts the parallel e g, as at i, is the ships place. What has been done thus by drawing Lines, may be performed by the intersection of two small Arches, or Lines and a Rular, without drawing long Lines: for a Rular will supply Lines without drawing them.

To find the Latitude, Longitude, Course and Distance between any two places already laid down in the Chart.

To find the Latitude.

Take with the Compasses the neareſt Distance between the given place c, and some parallel of Latitude, as A D; then setting one foot of the Compasses on the end of the parallel, as at A apply that extent to the graduated Meridian, the right way (*viz.* that way that the

the place lyeth from the parallel) and the other foot will ſhew as at I, the Latitude of the place.

To meaſure the Longitude, or rather Difference of Longitude.

Take with the Compaſſes the neareſt Diſtance between the given place c and ſome Meridian as AB; then ſetting one foot on the end of the Meridian A, apply the extent to the graduated parallel, and the other foot will ſhew the Difference of Longitude.

To find the Courſe between any two places in the Chart.

Lay a Rular over the two places, as c i, ſee what Rumb-Line runs parallel thereto, as A l, and that ſhews the Courſe: But if the Rumb-Lines be not drawn, take 60 deg. from the Chords, and ſetting one foot in O, where the Rular cuts ſome Meridian, deſcribe the obſcure Arch p q, which meaſured on the Line of Rumbs on your Scale, ſhews the Courſe three points from the Meridian, *viz.* North Weſt by North.

To meaſure the Diſtance between two places.

If the two places differ only in Latitude, the Difference of Latitude is the Diſtance between them. If the two places are both in the ſame Latitude, take the Diſtance between them, and apply the Compaſſes to the graduated Meridian, one foot ſtanding as much above the Latitude, as the other below, the Degrees intercepted is the Diſtance, or rather thus, take a Degree of the Meridian at that Latitude, and turn it between the two places by a ſtraight Line, and ſo often as you ſhall find that length between the two places, ſo many ſcore Leagues is the diſtance between them.

If the two places differ both in Latitude and Longitude, take the difference of Latitude between them in degrees from the Line AD, and laying a Rular upon the two places, apply one point of the Compaſſes ſo to the edge of the Rular, that the other turned about may juſt touch ſome Eaſt or Weſt Line croſſed by the Rular; then take the diſtance by the edge of the Rular, from the place where the Compaſſes reſted, to the place where the Rular croſſes the ſaid Eaſt and Weſt Line, that extent meaſured on the Line AD, ſhews the Degrees or Scores of Leagues between the two places.

To keep a Mercator-Account of the Ships place daily by the observed Latitude, and the Course.

Admit a Ship sail from A, a place in Latitude North 44 deg. 00 min. North by West: till she's arrived in the Latitude 44 deg. 30 m. and from thence North West by North till in the Latitnde 45 deg. 18 min. and afterwards North West by West till she fall in Latitude 46 deg. what's the difference of Longitude, and also the Course and Distance made good from the first place of Departure?

First draw the parallel of 44 deg. 30 min. Latitude, where it cuts the North by West, or first Rumb-Line from the Meridian, as at c, is her place on that Rumb, then draw the parallel of 45 deg. 18 min. Latitude d e, and continue the North West by North, or third Rumb Line, till it cuts it in f; then through c draw a parallel to the Rumb Line A f as c g, the point g where it cuts the Parallel of Latitude is the ship at the end of her North West by North Course.

Thirdly, draw the parallel of 46 deg. and continue the North West by West Rumb Line, till it cut it in h, and through g draw a parallel to A h as g i, so is i her place at last: now taking i k, and applying it to AD. you'll find she's 2 deg. 20 min. Longitude West from A; and by laying a Rular over A and i, you will

will find by comparing it with the Rumb-Lines ſhe has made a North Weſt by North half Weſterly Courſe, or better, *&c.*

Arithmetick.

It may be performed by the third Caſe, or Propoſition of Mercators Sailing.

This way of keeping an account of a Voyage is not contemptible in parts where there is a certainty of a clear Heaven to obſerve in, ſo that care be taken ſtill to rectifie the Compaſs, keep her ſteered ſteady, Leeway allowed for, and the Currents tryed once a day, all which trouble is ſufficiently recompenſed in the omitting the continual keeping an account of the Diſtance.

But it is objected, that becauſe there's no way of examining, or diſcovering whether any error be in their account or not, unleſs ſome ſmall glimpſe from the Variation, and if diſcovered, yet here's no way of correcting it, until ſome way be found for obſerving the Longitude (after which this will be the beſt and only way) it's not a ſafe method to rely on.

To which I anſwer, that if an account of the ſhips way be kept, alſo the correction may be made by that: but then it will be better to keep the whole account by her Courſe and Diſtance and correct by the obſerved Latitude, like as in

in *Plain Sailing*: and as it doth follow.

To keep a true account of the ſhips place daily, by her Courſe and Diſtance.

Admit a ſhip ſail from A in Latitude 44 deg. 00 min. North, North North Weſt 60 Leagues, or 180 miles, then Weſt North Weſt 30 Leagues, or 90 miles: Afterwards North by Weſt half Weſterly, 20 Leagues, or 60 miles: and it be demanded what Latitude ſhe's in, the Difference of Longitude, and the Courſe and Diſtance ſhe has made good?

Taking 60 Leagues from the Line AD, prick them on the North North Weſt Line from A to m, and taking the neareſt Diſtance to AD, and applying it to the Line X Z, you'll find ſhe's in the Latitude 46 deg. 48 min. then drawing the parallel of 46 deg. 48 min. Latitude, and producing the North North Weſt Line, they will meet in m the firſt point.

Secondly, through m draw a parallel to the Weſt North Weſt Line, as m n, and lay thereon 30 Leagues from m to o, and taking the neareſt Diſtance from o to the parallel 46 deg. 48 min. Latitude m q, ſet it on the Aſſiſtant Line from p to r, which ſhews you are now in Latitude 47 deg. 22 min. and drawing the parallel of 42 deg. 22 min. Latitude, where it cuts m o as at n, is her place

on

the Chart at the end of the ſecond Courſe. Thirdly, through n draw a parallel to the th by Weſt half Weſterly Rumb-Line, and k thereon 20 Leagues from North to South, taking the neareſt diſtance from South to th Weſt, the parallel of 42 deg. 22 min. tude, apply it to the Aſſiſtant Line, from u, which will ſhew the Latitude now to 48 deg. 20 min. Laſtly, draw the paral- f 48 deg. 20 min. and where it cuts n s t, is the ſhips place at the end of this d Courſe. Thus muſt they be proceeded if more. Now find the Longitude of the t t by the former Directions, and alſo Courſe and Diſtance made good from A.

CHAP. VI.

Obſervation, and the Uſe of Inſtruments.

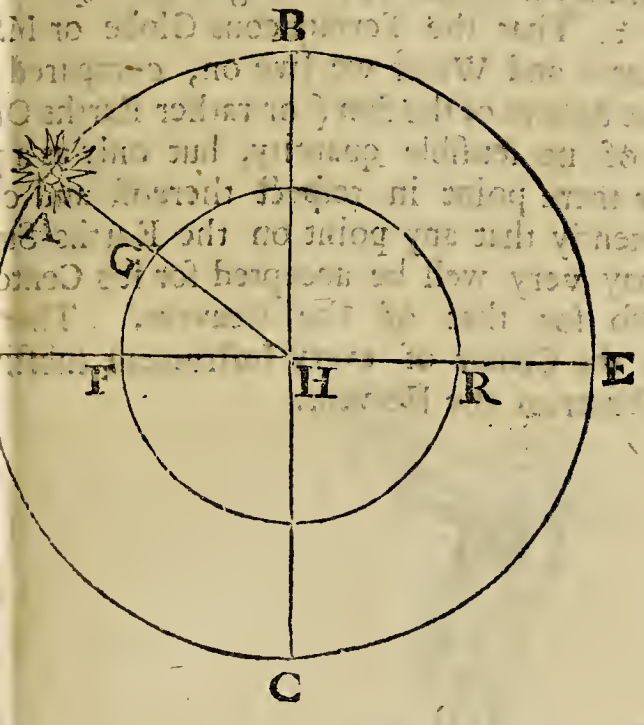
THis Art of Traverſing and Caravanning over *Neptune*'s vaſt Dominions, is not a le or ſingle Science; but a Complication e three moſt noble Sciences, *Arithmetick*,

Geometry, and *Aſtronomy*. It makes uſe o
rithmetick for Computation; Geometry
Delineation and Demonſtration; and A
nomy for Obſervation: which is clearly
preſſed in his Majeſties *Silver Badge* wor
the *Blew-Coat-Children* of the *Royal Found*
in *Chriſt's Hoſpital*, whereon are three W
for theſe three Sciences.

The firſt of theſe with the Table of N
bers is Arithmetick: the ſecond with the
angle is Geometry: and the third wit
Foreſtaff Aſtronomy.

Thus far having dealt with the two
without the third, here I ſhall handle the t
yet not without the two firſt (it being in
ſible) neither here ſhall I meddle with
of Aſtronomy; but only ſo much as imm
ately and directly tends to Navigation,
Nautical Obſervation.

A



Cœleſtial Obſervation is founded on theſe Principles.

That when many Circles are concentrick, ines drawn from their Center to the Cir- rences, divide them all in the ſame man- is in Example.

the Circles D B E, F G R be deſcribed he ſame Center H, and the Lines H F D, drawn, the Arches D A, F G ſhall be

like parts of their Circumferences, and
tain a like number of Degrees.

2. That the Terraqueous Globe or Ma
Earth and Water we live on, compared
the Sphere of the Sun (or rather Earths Or
is of no ſenſible quantity, but only as a p
or mere point in reſpect thereof, and co
quently that any point on the Earths Su
may very well be accepted for it's Cente
alſo for that of the Heavens. There
is the Center of every Inſtrument ſubſtit
Center of the Heavens.

e Figure of the Fore-ſtaff.

e Deſcription and Uſe of the Fore-ſtaff, or Croſs-ſtaff.

onſiſts of a ſtraight ſquare graduated Staff, four Croſſes or Vanes: the firſt and ſhorteſt

is called the *Ten Cross or Vane*, and belon
that side of the staff where the Divisio
gin at about three degrees, proceeding tow
the Eye (or flat) end to ten degrees: s
times the Thirty-Cross is so made, as that
breadth thereof serves instead of this *Ten-*
The next longer is called the *Thirty-Cross*,
belongs to that side of the staff where th
visions begin at ten degrees, and end at t
degrees; and this is called the Thirty-
half the length of the Thirty-Vane will r
on this Thirty-side from 30 deg. to 23 de
min. and the whole length from 30 deg. t
47 min.

The next longer is called the Sixty-C
and belongs to that side where the divi
begin at 20 deg. and end at 60, and is c
the sixty-side. The length of this Cross
reach on this sixty-side from 60 deg. t
30 deg.

The longest Cross is called the Ninety-C
and belongs to that side where the divisio
gin at 30, and end at 90, and is calle
ninety side of the staff.

Sometimes the several sides of the staff
numbered also with their Complements t
in small Figures.

The use of the Fore-staff.

The chief Use is either to take the Alt

the Sun or Stars, or the distance of two
s, and the Ten, Thirty, Sixty and Ninety
sses are to be used according as the Altitude
Distance is greater or lesser, that is, if it be
than ten degrees use the Ten Cross; if less
n. thirty degrees, the Thirty Cross; if less
n sixty degrees, the Sixty Cross: above
ch it is not so convenient for use as other
ruments.

To observe an Altitude.

Place the flat end of the staff to the outside
your eye, as near as you can, not to hinder
r sight, and look at the upper end of the
ss for the Center of the Sun, or Star, and
the lower end for the Horizon: but if you
the Sky instead of the Horizon, draw the
ss a little nearer to your Eye; but if you
the Sea instead of the Horizon, put the
ss a little further from your Eye, and so
ntinue moving and removing the Cross till
u see exactly the Sun or Stars center by the
e of the Cross, and the Horizon by the low-
end thereof. The degrees and minutes cut
the minor edge of the Cross, upon the side
the staff peculiar to the Cross you use, is
e present Altitude of the Sun or Star: but
it be the Meridian or greatest Altitude which
u are to find, you must continue your Ob-
rvation as long as you find the Altitude in-

creaſe, ſtill drawing the Croſs nearer to y
Eye; but when you perceive the Altitud
diminiſhed, which you'll eaſily diſcover
ſeeing at the repetition of the Obſervation,
Sea inſtead of the Horizon, forbear any fart
Obſervation, and do not alter your Croſs;
as the Croſs ſtands, count the degrees and
nutes on the ſide proper to the Croſs, wh
gives the Meridian Altitude required; and
Meridian Altitude ſubſtracted from 90, gi
the Zenith Diſtance, if it be not graduated
the ſtaff.

If it be hazy, or ſomewhat thick weath
the Fore-ſtaff may thus be uſed; but if
Sun ſhine out, they either obſerve the up
Limb of the Sun, and afterwards ſubſtract
Sun's Semidiameter from the Altitude, or
uſe a coloured Glaſs on the top of the Croſ
defend the ſight from the ſplendor of
Sun.

*To obſerve the Diſtance of two Stars, or the Mo
Diſtance from a Star.*

Place the Staff's flat end to the Eye, as
fore directed, and looking to both ends of
Croſs, draw it nearer, or remove it farther fr
the Eye, as you ſhall find occaſion, till y
can ſee the two Stars, the one on the one e
and the other on the other of the Croſs; t
look what degrees and minutes are cut on

e of the Staff belonging to that Vane in use,
d that is the true distance required.
Some use this Cross-staff backward, in ta-
ng the Sun's Meridian Altitude, thus.

*make a backward Observation of the Sun's Al-
itude with the Cross-staff.*

You must have an Horizon Vane to fix up
the Center, or eye-end of your staff; also
hooe of Brass to fit on to the end of any of
Crosses, which is instead of a Sight-Vane.
en, when you would observe, having put
the Horizon-Vane, and fix'd the Shooe to
end of a convenient Cross, turn your back
he Sun, and looking through the sight in
Brass Shooe, lift up or down the end of the
f, till the shadow made by the upper end
the Cross, fall upon the slit in the Horizon-
e; and at the same time you can see the
izon through the Horizon-Vane, then the
grees and Minutes cut by the Cross on the
per side is the Altitude: but if there be
d a Lens, or a small double Convex-Glass
he upperend of the Vane, to contract the
-beams and cast a small bright spot on the
izon-Vane, possibly it may be found more
venient than the shadow, for as much as
is commonly imperfect and double.

But if the Declination be the ſame w
that the Meridian Altitude is, and alſo gre
er than the Meridian Altitude, then the *S*
or *S*tar may have two Meridian Altitudes
twenty four hours, *viz.* the one above t
Pole, and the other below. And then t
ſum of the Codeclination and Altitude is t
heighth of that Pole towards which the Dec
nation is.

The Figure of the Quadrant.

The

The Deſcription and Uſe of th Quadrant.

This Inſtrument is ſaid to have been th Contrivance of Captain *Davis*, that wrote th *Seaman's Secrets*, and therefore is ſometim called *Davis*'s Quadrant. It's a very conv nient Inſtrument for to take the Sun's Altitud at Sea; it conſiſts of three Vanes, A, B, C and two Arches: that at A is called the Ho rizon-Vane; that at B the Shade-Vane, becau of it's giving the ſhadow upon the Horizo Vane, in time of Obſervation; and that at the Sight-Vane, becauſe in time of Obſerv tion it's placed at the Eye.

The leſſer Arch d e is the Sixty Arch; an that marked f g the Thirty Arch. Th Sixty Arch is divided into ſixty degrees, com monly by every five, but ſometimes by ſing degrees; in time of Obſervation the Shad Vane is placed upon this Arch always to a even degree. And the Thirty Arch into 3 degrees, and each of thoſe degrees into m nutes, by Diagonal Lines: in time of Obſe vation the Sight Vane ſlides upon this Arc Both Arches together (tho of differing Ci cles) contain ninety degrees, whence it's pr perly called a Quadrant.

To observe with the Quadrant.

Having put the Horizon-Vane upon the end of the Quadrant at A, the Shade-Vane upon the ſixty Arch d e, to a number of degrees leſs than the Co-altitude by 15 or 20 degrees, and the Sight-Vane upon the thirty Arch F G, turning your back towards the Sun, lift up the Quadrant, and look through the ſmall hole in the Sight-Vane, and ſo raiſe or lower the Quadrant, till the ſhadow of the upper edge of the Shade-Vane fall upon the upper edge of the ſlit in the Horizon-Vane; then if at the ſame time the Horizon appear through the ſaid ſlit in the Horizon-Vane the Obſervation is finiſhed: but if the Sea appear inſtead of the Horizon, then remove the Sight-Vane lower towards F; but if the Sky appear inſtead of the Horizon, then ſlide the Sight-Vane a little higher, and ſo continue removing your Sight-Vane, till the Horizon appear through the ſlit of the Horizon-Vane, and the ſhadow of the Shade-Vane fall at the ſame time on the ſaid ſlit of the Horizon-Vane; then look how many degrees and minutes are cut by the edge of the Sight-Vane that anſwers to the ſight-hole, and to them add the degrees that are cut by the upper edge of the Shade-Vane, the ſum is the Zenith-Diſtance, or Complement of the Altitude: but to find the Sun's Meridian, or greateſt

Altitude,

Altitude, you must continue your Observation as long as you see the Altitude increase, which you'll perceive by having the Sea appear at the repeating the Observation, instead of the Horizon, by removing the Sight-Vane lower; but when you see the Sky appear instead of the Horizon, the Altitude is diminished; therefore desist from farther Observation at that time, and add the degrees upon the sixty Arch to the deg. and min. upon the thirty Arch, the sum is the Zenith-Distance or Co-altitude of the Sun's upper Limb or Edge.

2. Of late there has been used a Lens or double Convex-Glass fix'd in the Shade-Vane, which contracts the Rays, and casts them in a small bright spot on the slit of the Horizon-Vane, instead of the Shade, which has much improved the Instrument, if the Glass be well and truly fix'd; for now it may be used in hazy weather, and that so thick an haze that an Observation can hardly be made with the Fore-staff; also in clear weather the spot is more defined and conspicuous than the shadow which at best is not terminated: this was the contrivance of ingenious Mr. *Flamsted*.

1. Seeing it's the Zenith-Distance, or Co-altitude of the upper Limb of the Sun that is given by the Quadrant, when observing by the upper edge of the shade, and not the Center, you ought to add 16 min. the Sun's semidiametre, to that which is produced by your Observation,

ſervation, and the ſum is the true Zenith-Diſtance of the Sun's Center, but if you obſerve by the lower part of the ſhade of the ſhade-Vane, then it's the lower Limb of the Sun that gives the ſhade, and therefore you muſt ſubſtract 16 minutes from what your Inſtrument gives: but again conſidering the height of the Obſerver above the water, which is commonly between 16 and 20 Feet, we may take five or ſix from the ſixteen minutes, and make the allowance but ten or twelve minutes, to be added inſtead of the ſixteen minutes.

Note alſo that the Refraction of the Sun or Stars, cauſeth them to appear higher than they are, therefore when you have made your Obſervation, look page the Refraction anſwering thereto, and ſubſtract it from your Altitude, or add it to the Zenith-Diſtance, ſo ſhall you have your Altitude exact and correct.

Rules for finding the Latitude, or Heighth of the Pole; by the Zenith-Diſtance, Meridian or Altitude of the Sun, or Stars, and their Declinations.

Note that ſo much as the Zenith is diſtant from the Equinoctial towards the North or South, which is called Latitude, ſo much is the

the respective Pole elevated above the Horizon.

If the Sun or Star have no Declination, the Zenith-Distance is the Latitude, and then if the Sun or Star come to the Meridian due North, the Latitude is Southerly; if it come to the Meridian South, the Latitude is Northerly.

If the Sun or Star be in the Zenith, then the Declination is the Latitude; and if the Declination be Southerly, the Latitude is Southerly; but if the Declination be Northerly, the Latitude is Northerly.

In all other cases consider the position of your Zenith, the Equinoctial and Star, whether the Zenith be between the Equinoctial and Star; or the Star between the Equinoctial and Zenith; or the Equinoctial between the other two; for according thereto is the Rule of Working varied; but the position of the Zenith is known by the Meridian, Altitude and Declination, and therefore shall form my directions according.

1. If the Declination be North or South, either of the Sun, or Stars, and the Meridian Altitude be the same way that the Declination is, the Difference between the Declination and Zenith-Distance is the Height of that Pole towards which the Declination is.

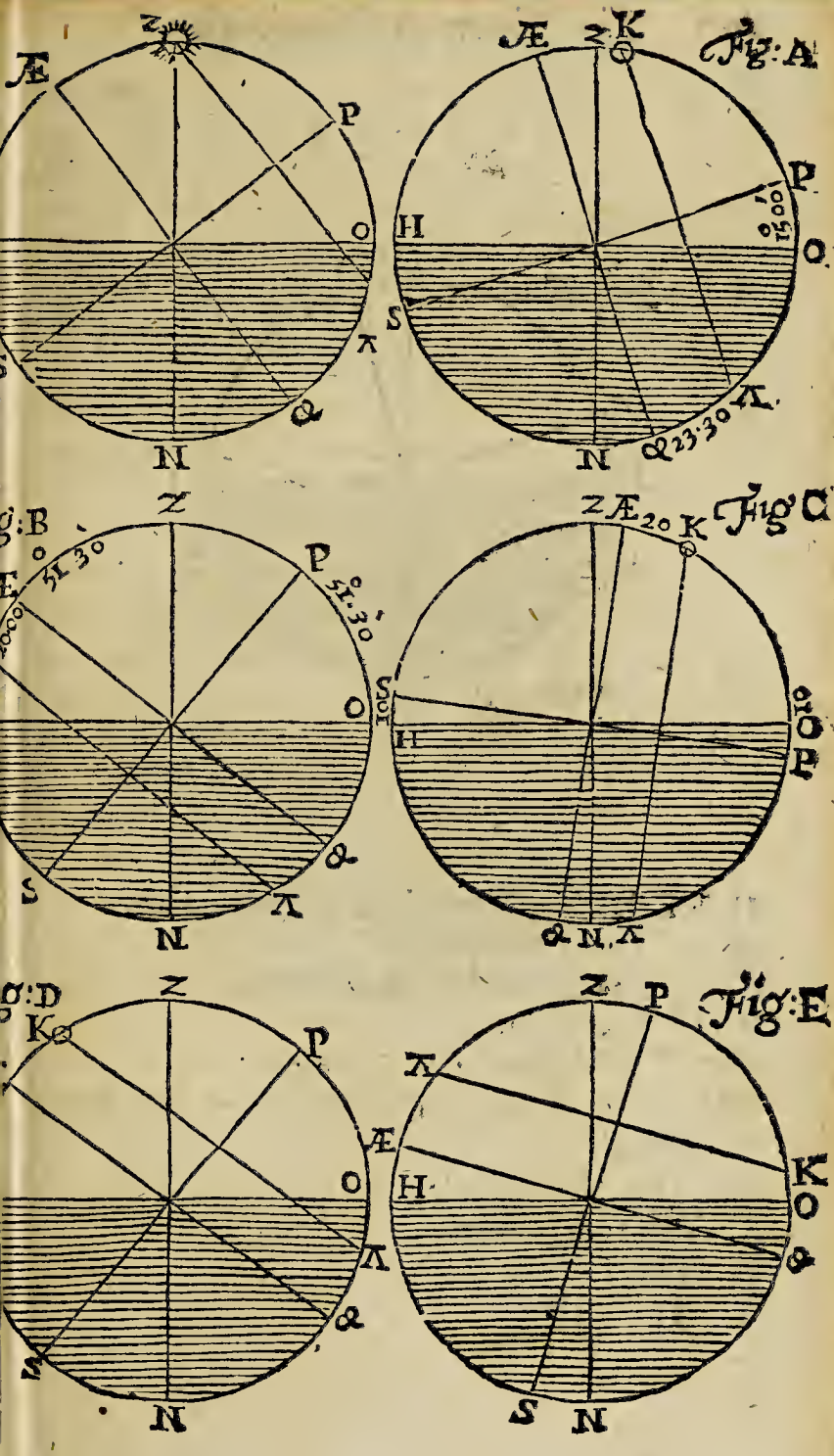
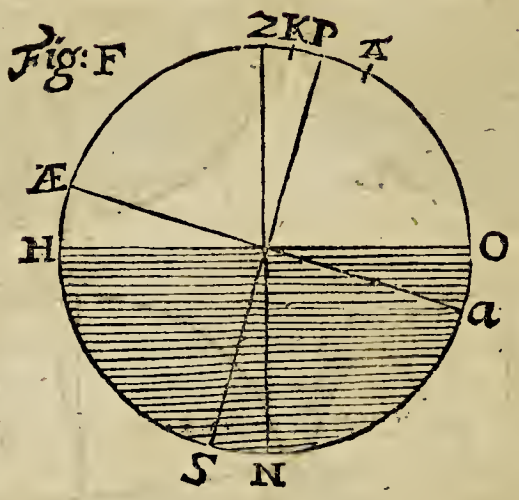
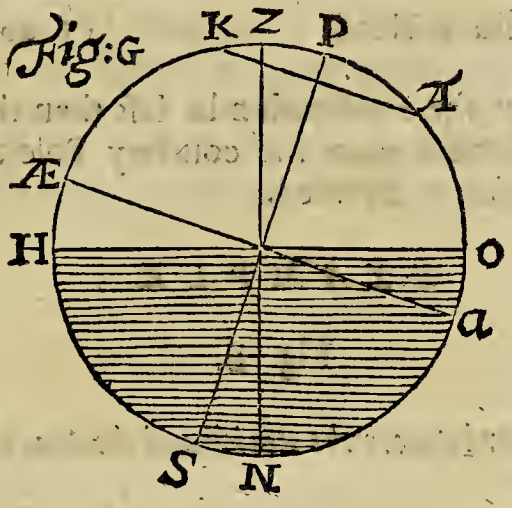

Z
Æ
P
O
N
Fig: A
Æ Z K
H
S
23·30
Fig: B
Z
51·30
Fig: C
Z Æ 20 K
Fig: D
Fig: E
S N

Fig: F



H Æ Z P O N Represents the Meridian.
Æ æ The Equinoctial.
K A The Parallel of Declinations.
H O The Horizon.
S P The Axis of the Equinox.
Z N The Axis of the Horizon, and Prime Vertical.
P The North Pole.
S The South Pole.
Z The Zenith.
N The Nadir.

H The South Point of the Horizon.
O The North Point.
H K or O K The Meridian Altitude.
Z K The Co-altitude, or Zenith-Distance.
Æ K The Declination.
Z Æ The Latitude.
O P The Poles Observation.



EXAMPLE.

EXAMPLE.

Fig. A.

The Zenith between the Equinoctial, and the Sun, or Star.

	Deg.	Min.	
The Declination North	23	30	Æ K
The Zenith Distance North	8	30	Z K
The Latitude North	15	00	Æ Z

Except the Declination be less than the Zenith Distance, then the contrary Pole to the Declination is elevated.

EXAMPLE.

Fig. B.

The Equator between the Zenith and the Sun, or Star.

	D.	M.	
The correct Zenith Dist. South.	71	30	Z K
The Declination South.	20	00	Æ K
Latitude North.	51	30	Æ Z

EXAMPLE.

EXAMPLE.

Fig. C.

	D. M.	
The Zenith Distance North.	30 00	Z K
The Declination North	20 00	Æ K
Latitude South	10 00	Z Æ

If the Declination of the Sun or Stars be North or South, and the Zenith Distance be contrary to the Declination, the sum of the Co-altitude and Declination is the heighth of that Pole that the Declination is towards.

EXAMPLE.

Fig. D.

The Sun or Star between the Zenith and the Equinoctial.

	D. M.	
The Zenith Dist. South.	31 30	Z K
The Declination North.	20 00	Æ K
Latitude North.	51 30	Z Æ

EXAMPLE.

EXAMPLE.

Fig. E.

The Sun or Star between the Zenith and Equinoctial.

	D. M.	
Declination North 23 deg. 30 min. Compl.	66 30	P K
Meridian Altitude North.	8 30	K O
The Elevation of the North Pole.	75 00	P O

Except the Meridian Altitude be more than the Declination, then ſubſtract the Zenith Diſtance from the Codeclination, and the Remainder is the height of the Pole, towards which the Declination is.

EXAMPLE.

Fig. F.

The Zenith between the Equinoctial and Star.

	D. M.	
The Declination North	80 00	Æ K
The Zenith Diſtance North	5 00	Z K
Latitude North	75 00	Z Æ

Note

Note that which way ſoever the Meridian Altitude be, if the Meridian Altitude and twice the Codeclination be leſs than 180, the Sun or Star hath two Meridian Altitudes, and by the ſecond Rule you may have the Latitude.

EXAMPLE.

Fig. G.

The Sun or Star between the Equinoctial & Zenith.

	D. M.	
The Meridian Altitude South	77 00	H K
The Declination North 62 deg. 00 min. the Compl.	28 00	K P
———	28 00	K A
	133 00	H A Leſs

than 180 deg. therefore by the ſecond Rule,

	D. M.	
The Zenith Diſt. South	13 00	K Z
The Declinat. North	62 00	Æ K
The Latitude North	75 00	Z Æ

That the attendance on a Star's coming to the Meridian, might not be tedious, I ſhall ſhew.

To find the time of a Stars coming to the Meridian any day.

Having looked the Right Aſcenſion of both the Star and Sun in their proper Tables, ſubſtract the Right Aſcenſion of the Sun from the Right Aſcenſion of the Star: but if the Stars Right Aſcenſion be leſs than the Sun's, ſo that you cannot ſubſtract, add thereto twenty four hours, and then ſubſtract, and the Remainder, if under twelve hours, is the time of the Stars coming to the Meridian after noon; but if the Remainder be more than twelve hours, ſubſtract 12 therefrom, and the Remainder is the time after Midnight.

EXAMPLE 1.

September 15. it's required to know when *Fomahant* comes to the Meridian, I find in the Table the Star's Right Aſcenſion to be 22 hours, 44 m. and the Sun's Right Aſcenſion 12 h. 1 m. which ſubſtracted from the Star's Right Aſcenſion, leaves 10 h. 31 m. the time of the Star's coming to the Meridian after noon.

EXAMPLE.

EXAMPLE II.

uppoſe the time that the Bull's South Eye
nes upon the Meridian, *Feb.* 28, 1688, be
uired,

	H.	M.
Right Aſcenſion of the Star	22	40
enty four hours added	24	00
	46	40
Sun's Right Aſcenſion ſubſtract	23	25
ains	23	15

true time that the Bulls Eye will come to
Meridian that night.

ind at any time what Star is then upon the
eridian.

o the Sun's Right Aſcenſion add the time
Noon given, and the ſum is the Right A-
ſion of the point of Heaven, that will
e to the Meridian at the propoſed time,
which enter the Table of the Stars Right
nſion, and ſee what Star hath ſuch right
nſion, or neareſt thereto, and that is the
ſought for.

EXAMPLE.

September 25, let it be required to know w
Star will be upon the Meridian at eleven of
Clock at night.

	H.	M
The Sun's Right Aſcenſion is	12	4
The time from Noon	11	0
Their ſum is	23	4

The Star that is neareſt in Right Aſcenſi
Marchab, whoſe Right Aſcenſion is 23 ho
50 minutes, and comes to the Meridian wi
4 minutes of 11 a Clock, the time propo

*To find the time of the Sun-Riſing, or Sett
with the length of the day and night in any
of the World.*

In Table, page find the day of
Month in the two outward Columns of Mo
and the Latitude you are in at the Head of
Table, and in the ſquare meeting of theſe
you ſhall find the time of the Sun's Riſin
Setting.

If you double the time of the Sun's Ri
you have the length of the night: but if
do

ble the time of the Sun-setting, you have length of the Day.

EXAMPLE.

dmit the time of the Sun's Rising, Setting, h of the Day and Night be required on *mber* 18, in the Latitude 28 deg. North. ere is neither the day of the Month, nor Latitude to be found exactly; but I can *November* 17 in the Table, and Latitude eg. which are the neareſt to thoſe given, ollowing theſe in the ſquare of meeting, I the Sun to ſet at 5 hours, 8 min. and e 49 min. after ſix of the Clock: 5 h. n. doubled gives 10 h. 16 min. the length e day, and 6 h. 49 m. doubled: gives the n of the night, 13 h. 38 m.

l the time of any Star that is between the Tro-s, Riſing and Setting with the time of its g above the Horizon in any place of the World.

ſt, Look in the Table of the Sun's De-on, what day in the year the Sun will as much Declination as the Star, then hat day, and the given Latitude enter the of the Sun's Riſing and Setting, and in mmon Angle you will have the Stars ſemi-l Arch, or half time of it's being above

the Horizon, if in the entring you look t
Month and Day in the Left Hand Column, a
the Latitude North, or in the Right Hand C
lumn, and the Latitude South. Now if y
ſubſtract theſe hours and minutes from the ti
of the Stars coming to the Meridian, the R
mainder will be the true time of the Star's
ſing; but if you add, the ſum will be the ti
of the Stars ſetting, and that before Midni
if the ſum be leſs than twelve hours; but i
exceed twelve, caſt away twelve, and the
is the time after Midnight.

EXAMPLE I.

Let it be required to find the time of
Riſing and Setting of the Bull's South Eye,
eighteenth of *November*, Latitude 42 deg.
min. North.

The Declination of this Star is 15 deg
min. North, and by the Directions before
ven, it will come to the Meridian that da
twelve of the Clock at night.

By looking in the Tables of the Sun's D
nation, I find the Sun to have ſuch Declina
as this Star, *viz.* 16 deg. *ferè* on the tw
third day of *April*, which twenty third
looked in the Table of the Sun Riſing u
42 deg. Latitude (or that being not t
found) under 40 deg. gives 6 h. 54
which, ſeeing the Declination and Latitud

h North is the ſemidiurnal Arch, or time
t the ſtar is paſſing from the Horizon to the
rldian ; or from the Meridian to the
rizon.

	H.	M.
en the time of the Stars South	12	01
e Stars ſemidiurnal Arch.	6	54
e time of the Star's Riſing, P. M.	5	07
e time of the Stars Riſ. in M.	6	54

EXAMPLE II.

Let it be required to find the time of the
ſing and ſetting of *Aldebaran*, the eighteenth
November in Latitude 42 degrees, 00 minutes
uth.

The time of it's coming to the Meridian
t day, is twelve of the Clock at night, and
Sun comes to have equal Declination with
on the twenty third of *April*.

Looking *April* 23, on the Right Hand of the
ble under 40 degrees Latitude, I find the
rs ſemidiurnal Arch to be

	H.	M
	5	6
Which ſubſtracted from the time of the Star's coming to the Meridian, or Northing ———	12	
The time of the Star's Riſing in the Evening ———	6	5
The time of the Star's ſetting in the Morning ———	5	

EXAMPLE III.

Let it be required to find the time of Riſing and Setting of *Syrius*, the fifteenth *November* in Latitude 50 deg. 00 min. Nor The Declination of this ſtar is 16 deg. 15 nutes ſouth, and the ſun comes to have much ſouth Declinat. *October* 27, with wh entring the Table of ſun's Riſing, I find ſemidiurnal Arch to be

	H.	M.
	4	40
ne time of coming to the Meridian, I find	2	26
which I add	12	00
	14	26
ne ſemidiurnal Arch ſubſtracted	4	40
ne time of the ſtar's Riſing in e Evening	9	46
ne time of its ſetting in the orning	7	06

nearly eſtimate the time of the Moon's Riſing, or Setting.

At the New ſhe riſeth and ſetteth with the n.

At the Full ſhe riſeth when the Sun ſets, and ts when the Sun riſeth.

At the beginning of her Increaſe, ſhe riſeth er Sun-Riſing, and ſets after Sun-ſetting.

At the beginning of her Decreaſe, ſhe riſeth little after the Sun ſets, and ſets a little before e Sun riſeth.

At her firſt Quarter ſhe riſeth about Noon, nd ſets about Midnight.

Laſtly obſerve, that ſhe riſeth every d later than the other by about 48 minutes.

To find the Diſtance of the Sun or a Star's Riſi from the Eaſt, or ſetting from the Weſt, and co ſequently what point of the Compaſs it ſhou riſe, or ſet on in any place of the World.

Look for your Latitude in the Head of t Table, and the Declination in the firſt Colum on the Left Hand, and in the common Ang of meeting you'll find the Amplitude deſire which if divided by eleven degrees and a qua ter, will give the Points of the Compaſs.

EXAMPLE I.

In the Latitude 42 deg. 00 min. North, t Sun's Declination being 11 deg. 00 min. Nor I demand the Amplitude.

The Table being entred, as directed, t Amplitude, is found 14 deg. 53 min. whi is one Point and a quarter.

If the Declination be North, the Amp tude is North, and if the Declination be ſouth ſo that here the the Declination being Nort the Amplitude is 14 deg. 53 min. North, a the ſun or ſtar ſhould riſe Eaſt by North, o quarter Northerly, and ſet Weſt by North o quarter Weſterly.

The Description and use of the Nocturnal.

There are two kinds of Nocturnals, the
ne made for the Great Bear, and the other for
e little Bear; yet both consisting of like
rts, one Description will serve both. This
strument is composed of three pieces, or
rts, the first and biggest on which is the
ndle by which, to hold it in time of Obser-
tion, hath on the fore-side two Circles, in
e outermost of which are the Days of the
onths, and upon the innermost the twenty
ur hours: upon the back-side are the thirty
o points of the Compass, and sometimes,
pecially if it be for the Little Bear, the Dist.
the Pole-star, above or beneath the Pole.

If the Nocturnal be for the Great Bear, then
u'll see in the Circle of Month *February* 17,
the top: but if it be for the Little Bear,
ril 25.

The second, or middle piece, or part con-
ins two Circles and a small Tooth, or Index:
e outermost Circle is divided into twenty
ne days and a half, for the Moon's Age, the
nermost into twenty four hours: the Index
a little short peg standing out from the edge,
d is to be set to the day of the Month, as
casion requires.

The third and upper, or innermost part, or
ece is a long Index, the edge of which that

comes from the Center muſt be brought ove
the Guards in obſerving. Sometimes on
Nocturnal is made for both Bears.

*To find the hour of the Night, and upon what poi
of the Compaſs the Guards are.*

Firſt, ſet the Tooth of the middle part t
the day of the Month, then lift up the Inſtru
ment, and hold it as upright as you can, wit
the fore-ſide towards you, and afterwards bo
the upper end or tip on the top of the Noctu
nal, ſo much towards you, that looking throug
the Center-hole in the middle of the Noctu
nal you may ſee the Pole-ſtar. Now when yo
ſee the Pole-ſtar through the hole, turn th
long Index or Rular about, till by the edg
coming from the Center, you can ſee the fir
of the Guards of the Little Bear; if th
Nocturnal be made for the Little Bear, or el
to the Pointers of the great Bear, then ſhall th
edge of that Index or Rular ſhew upon the i
nermoſt Circle of the middle part or piece
the hour of the night; and at the ſame tim
on the back-ſide of the Nocturnal, the Poi
of the Compaſs on which the Guards are.

If you deſire to be more exact in the time
the night, take the Altitude of ſome know
ſtar, and proceed according to followi

To find the time of the Moon's coming to the Meridian by the Nocturnal.

Look for the Moon's Age in the outermoſt Circle of the middle piece of the Nocturnal, and right againſt it on the innermoſt Circle of the ſame piece is the time of her coming on the Meridian.

The uſe of the following Table of North Stars diſtance above or beneath the Pole.

Having taken the Altitude of the Pole Star, obſerve with the Nocturnal, as above directed, upon what Point the Guards or Pointers are: then looking in this Table for the Diſtance or Declination, and if the ſtar below the Pole, add it to the Altitude; but if the Star be above the Pole, ſubſtract, and the Sum or Remainder is the Latitude of the place.

A Table of the Distance of the Pole Star above or beneath the Pole upon every Point of the Compass the Guards and Pointers are upon.

If the foremost part of the Guards be ascend. from the North, or lower part of the Meridian.

Points on the Nocturn.	For for. G. lit B.	
	D	M
North	2	09
N. by E.	1	52
N. N. E.	1	29
N. E. by N.	1	02
N. E.	0	35
N. E. by E.	0	06
E. N. E.	0	22
E. by N.	0	52
East.	1	18
E. by S.	1	41
E. S. E.	2	01
S. E by E.	2	16
S. E.	2	25
S. E. by S.	2	30
S. S. E.	2	29
S. by E.	2	22
S uth.	2	11
S. by W.	1	55
S S. W.	1	34
S. W. by S	1	10
S. W.	0	43
S. W. by W	0	14
W. S W.	0	15
W. by S	0	44
West.	1	11
W. by N	1	35
W. N. W.	1	58
N. W. by W.	2	14
N. W.	2	25
N. W. by N.	2	30
N N. W.	2	21
N. by W.	2	12

The Pole Star is above the Pole.

The Pole Star is under the Pole.

The Pole Star is above the Pole.

If the Pointers be descending from the South, or upper part of the Meridian.

If the Pointers, otherways called the Afterwheels of the Wain be ascended from the North, or lower part of the Meridian.

For the Pointers of great Bear.	
D	M
2	20
2	30
2	35
2	33
2	26
2	13
1	55
1	33
1	07
0	38
0	08
0	22
0	52
1	20
1	44
2	04
2	20
2	30
2	29
2	28
2	26
2	13
1	55
1	33
1	07
0	38
0	08
0	22
0	52
1	20
1	44
2	04

The Pole Star under the Pole.

Above Pole.

This Table is added merely upon the Account of the World's being uſed to have it inſerted in Books of this kind, and will cenſure any Book imperfect, that ſhall be without it, tho of vere little Uſe.

Of Spherical Triangles.

1. A Spherical Triangle is a Triangle made on the ſurface of the Globe, by three Arches of great Circles, mutually interſecting each other.

2. Every Spherical Triangle conſiſts of ſix parts, *ſcil.* three ſides, and three Angles.

3. The ſides are Arches each leſs than a Semicircle.

As the ſides of Plain Triangles are meaſured by a ſcale of equal parts, ſo theſe are to be meaſured by an Arch of equal parts, or Degrees.

4. The meaſures of the Angles are Arches of Great Circles deſcribed from the Angular Points, and ſubtending the Angles.

5. A great Circle of the Sphere is that which biſects, or divides the Sphere into two Hemiſpheres, or halves; as the Equinoctial, Ecliptick, Horizon, Meridian, *&c.*

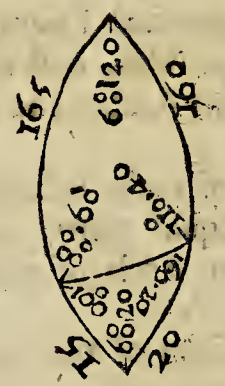
6. The Poles of a Circle is a point in the ſurface of the Globe, diſtant always 90 degrees from

from the Circumference of its Circle.

7. The Distance of the Poles of two great Circles is equal to the Angle made by them at the point of Intersection. Therefore

8. Those Circles which cut each other at Right Angles, the one of them shall pass by the Poles of the other, and Cont.

7. If two sides of a Spherical Triangle be continued, they shall intersect again at a semi-circle, and shall make an Angle equal to the former opposite Angle; as in the Figure.



Hence if a Spherical Triangle hath two sides, each of them severally greater than a Quadrant, you shall in the resolving thereof keep the least side, with it's opposite Angle, and for the other two both sides and Angles, take their Complements to 180 deg.

10. If

If three great Circles make by their Interſections a ſpherical Triangle, and if the Poles of thoſe Circles be the Angular Points of another Triangle, the Angles of the firſt Triangle ſhall be equal to the ſides of the ſecond; and the ſides of the firſt to the Angles of the ſecond.

Hence it is evident how the Angles of a Triangle may be changed into ſides, and cont.

11. The ſum of the three Angles of a ſpherical Triangle is greater than two right Angles, but leſs than ſix.

12. Two Angles of any ſpherical Triangle are greater than the difference between the ſum of the three Angles, and a ſemicircle.

13. Any ſide being continued, the exterior Angle is leſs than the two oppoſite inward ones.

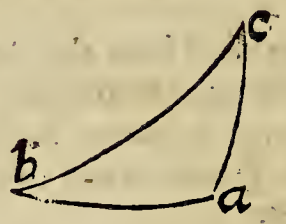
14. In any ſpherical Triangle, the difference of the ſum of two Angles, and a whole Circle is greater than the difference of the third Angle and a ſemicircle.

15. A ſpherical Triangle is either Right-Angled, or Oblique-Angled.

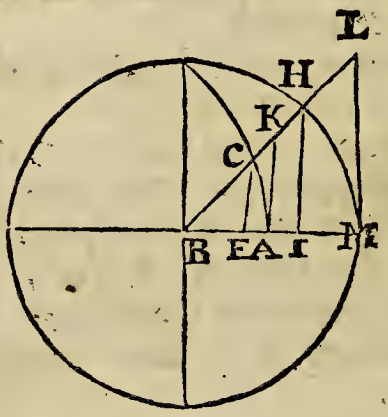
16. A Right-angled ſpherical Triangle is that which hath one Right Angle at the leaſt.

17. In a Right-Angled ſpherical Triangle, either of the Oblique Angles is greater than the Complement of the other; but leſs than the Difference of the ſame Complement to a ſemicircle.

Of Right-Angled Spherical Triangles.



In these there are five parts besides the Right Angle (which is esteemed as none) the Angles b c, and sides a b, b c, and c d, any two whereof being given, a third may be found, by the two following Axioms.



Præp. Let B A C repreſent a Right-Angled Spherical Triangle, right-angled at A; ſo that A B be the ſine of the Baſe, B C the ſine of the Hypoth, C F the Sine, and A K the Tangent of the other Leg, I H the ſine, and M L the Tangent of one of the Angles, *viz.* that at B.

AXIOM I.

As B A the ſine of one Leg,
Is to B M the Radius:
So is A K the Tangent of the other Leg,
To M L the Tangent of the Angle B.

AXIOM II.

As B C the ſine of the Hypoth,
Is to B H the Radius:
So is C F the ſine of the Leg C A,
To H I the ſine of the Angle B, and the contrary.

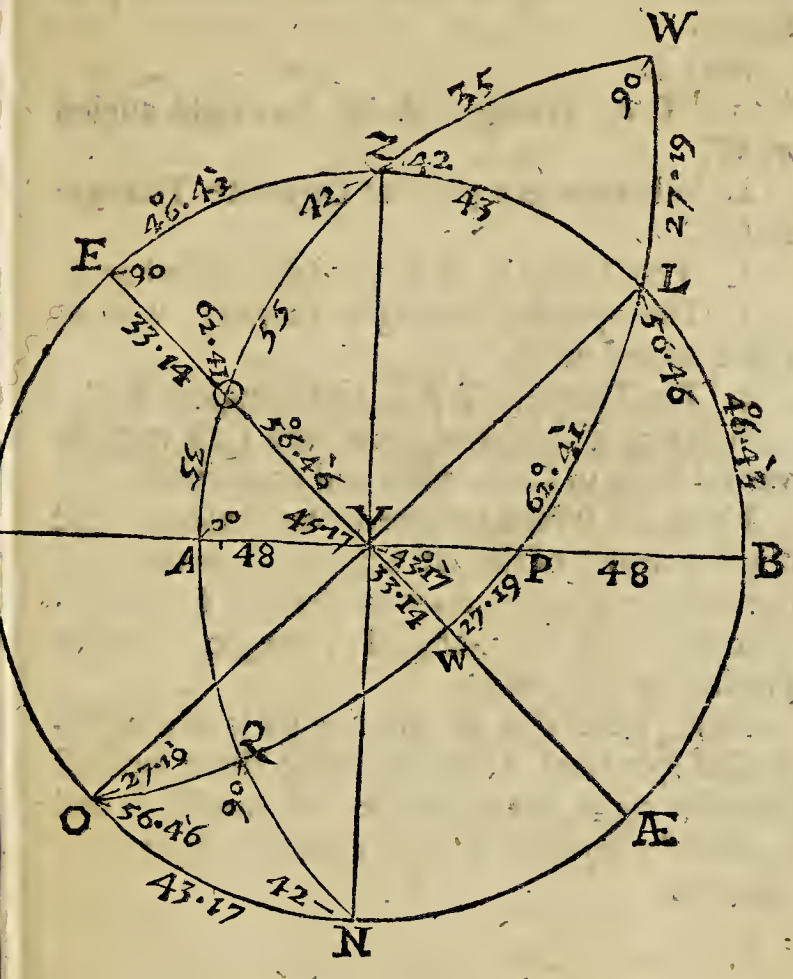
By theſe two, I ſay, may be ſolved all right-angled ſpherical Triangles; but then the ſides of the Triangle for the moſt part muſt be produced, that there may be divers Triangles made by their interſections (as in the next Scheam) conſiſting of parts of the firſt Triangle, or their Complements, and afterwards it muſt be conſidered to which of all thoſe Triangles one of the ſaid Axioms may aptly and

and immediately be applyed for finding the thing required, or it's Complement.

That any right-angled ſpherical Triangle having the ſides thereof continued to Quadrants, will produce five other right-angled Triangles, all made of the ſame parts, or the Complements of thoſe of the firſt Triangles.

See the Scheam.

Where



Where let E Z O be a right-angled Triangle projected, right-angled at E, let P be the Pole of the Circle Z O N, L the Pole of E V. Through

Through the points O P L describe the Arch O P L, and continue it beyond the Limb, *viz.* to W, where it shall concur with N O Z produced.

Here is

1. The Triangle Z W L, right-angled at W.

2. Whereto is equal the Oppoſite Triangle N Q O.

3. The Triangle O A V right-angled at A.

4. The oppoſite Triangle thereto V W P, right-angled at W.

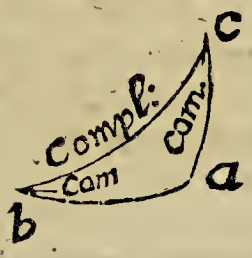
5. The Triangle P p L right-angled at B.

Whence it's evident how any Caſe may be varied both in Calculation and projection.

From the fore-mentioned two Axioms, and conſiderations of the laſt Scheam, was deduced the following noble Axiom, ſerving for the ſolutions of all right-angled Triangle, without producing any ſide.

Firſt, Note that of the five parts of a right-angled ſpherical Triangle, thoſe three fartheſt from the right Angle, as the two Angles b and c, and the Hypoth b c are called Complemental Parts.

There



There always comes three of the five parts into a queſtion, two given, and one required, and theſe three lie either all together, as b a, a c and c, or a c, c, b c or b c b, b a, or c, b c and b, b, b a, a c (for the Right Angle parts nothing) in all which five Caſes, a c, c. b, b c and b a are the means or middle parts, and the other are called Extreams adjacent or adjoyning, or elſe one part lyeth by it ſelf disjoyned from the other two, as b a, b c and c, or b c, b a, c a, or c b, b a, wherein b a, b c and c, are ſeparate from the reſt, and then that part which is alone and disjoyned is called the Mean, and the other two are called Extreams oppoſite, or disjoyned.

The

The General, or Fundamental Axiom.

The Sum of the Logarithm, Sines of the middle part and Radius, is equal to the sum of the Tangents of the Extreams adjacent, or of the Cosines of the opposite Extreams.

If the middle part be required, put the Radius first, that is, in the first place of a proportion; but if one of the Extreams be required, put the other Extream first.

This solves all the sixteen Cases of right-angled spherical Triangles.

Of Oblique Spherical Triangles.

In Oblique spherical Triangles there always comes four parts into the question; three given to find a fourth. There are twelve Cases, two whereof, *viz.* these, where the parts coming into the question are opposite, are solved by the next following Axiom alone.

AXIOM I.

In all Spherical Triangles the Sines of the Angles are directly proportional to the Sines of their opposite sides, and the contrary.

Eight more may be solved by letting fall a Perpendicular

Perpendicular from one of the Angles down upon the Baſe, whereby the Triangle is divided into two right-angled Triangles, and the ſolution requires two Operations.

Note, that if the Angles at the Baſe be both of one kind (that is both obtuſe, or both acute) the Perpendicular falls within the Triangle; if of divers kinds, without.

In letting fall the Perpendicular, note that for as much as in every of theſe 8 Caſes there is given a ſide, with an Angle adjoyning.

1. Let fall the Perpendicular from the end of that given ſide which is adjoyning to an Angle given, ſo that it may be alſo oppoſite to the ſaid Angle.

2. And when that is not ſufficient, let it be alſo in it's falling, oppoſite to the Angle required, or to the ſide required.

The firſt of theſe Conditions is neceſſary to be obſerved in all the eight Caſes mentioned.

But this being ſomewhat intricate, I ſhall lay down Mr. *Oughtred*'s Proportions, by which thoſe eight Caſes may readily be ſolved without any Perpendicular.

1. As the Sine of the Difference of two ſides,

Is to the Sine of half their ſum,

So is the Tangent of half the Difference of two Angles,

To the Cotangent of half the contained Angle.

2. As

2. As the Cosine of half the Difference of two sides,

Is to the Cosine of half their sum:

So is the Tangent of half the sum of two Angles,

To the Contang. of half their contained Angle.

3. As the Sine of half the Difference of two Angles,

Is to the Sine of half their sum:

So is the Tangent of half the Difference of two sides.

To the Tangent of half the interjacent sides.

4. As the Cosine of half the Difference of two Angles,

Is to the Cosine of half their sum:

So is the Tangent of half the sum of two sides,

To the Tangent of half the interjacent sides.

If the half Difference of two Angles be added to their half sum, the aggregate will be the greater Angle; but substracted from it, the Remainder will be the lesser. The same holds of the half sum, and half difference of two sides.

If you have two sides and an Angle opposite to one of them given, to find the third side, or two Angles with a side opposite to one of them, to find the third Angle, you must first by opposite sides and Angles, find another

Angle

ngle, or ſide, and then by inverting theſe opoſitions, proceed.

Three Sides being given to find an Angle.

Note, that the ſide oppoſite to the Angle quired, is here called the Baſe, and the o- er two the containing ſides.

Firſt, ſay, as the Radius is to the ſine of one the containing ſides, ſo is the ſine of the ner to a fourth ſine.

Then as that fourth ſine is to the ſine of half ſum of the three ſides, ſo is the ſine of the ference between that half ſum of the three es, and the Baſe, to a ſeventh ſine, to which the Radius, and half that ſum will be the ſine of half the Angle required.

If three Angles be given to find a Side:

Take the Complement of the greateſt An- to one hundred and eighty degrees, and n the Angles are changed into ſides, and operation will be the ſame with the laſt.

Of the COMPASS

THis Inſtrument called a Compaſs, is onl
ſuch a Compaſs-Card as is deſcribe
page made by the paſting a ſteel Wye
well touched with the Load-Stone, under th
Meridian, or North, and South-Line thereo
to ſhew in all places the Azimuths, eſpecially th
thirty two; called the Points of the Compaſ
which it doth not with the ſame exactneſs
all places alike; but has in moſt places a D
clination or Variation: the North Point, whi
is chiefly regarded in this matter, ſtanding
Point, two, nay, ſometimes three, and mo
from the true interſection of the Horizo
and North part of the Meridian, which is t
true North Point of the Horizon.

Which Variation, tho by ſome counted
imperfection in the Compaſs, I rather take
be it's greater perfection, Providence there
pointing at ſomething more excellent than
apprehended. How to obſerve the Magnet
Amplitude or Azimuth, by the Azimuth Co
paſs, I ſhall not need to ſhew: almoſt ev
one that maketh and ſelleth them, being re
to inſtruct you in that, *gratis*, if you buy o

o find the Variation of the Compaſs, which way it is, and how much.

Having obſerved the Magnetical Amplitude, ke the true Amplitude out of the Table of mplitudes, page thus, look the Lati- de on the head thereof, and the Declination own along the Left Hand Column, and under e Latitude, and right againſt the Declination, u'll have the true Amplitude. Now by theſe find the Variation, and which way it is, e following Rules will direct.

With the Chord of ſixty degrees deſcribe a rcle, and quarter it with two Diameters at ght Angles the one to the other, writing a- inſt the Extreams of the Diameters, North, uth, Eaſt, Weſt, as you ſee in the Figure. en take the true Amplitude, or Azimuth, d prick it from the proper point the right y, and ſo alſo prick off the Magnetical Am- tude, or Azimuth. Laſtly, take the di- nce between the Magnetical Amplitude, or imuth, and the North, and ſet it from the nt of true Amplitude, or Azimuth, North- rd, or towards the North, and the foot of Compaſſes will fall in a certain point, from ch, if you draw a Line through the Center, t Line will repreſent the Magnetical North, South Line, or Magnetical Meridian, and t way that this Point lieth from the North,

that way is the Variation, and juſt ſo much as is the Arch between the ſaid point and the North, which may be meaſured by the Chords.

EXAMPLE I.

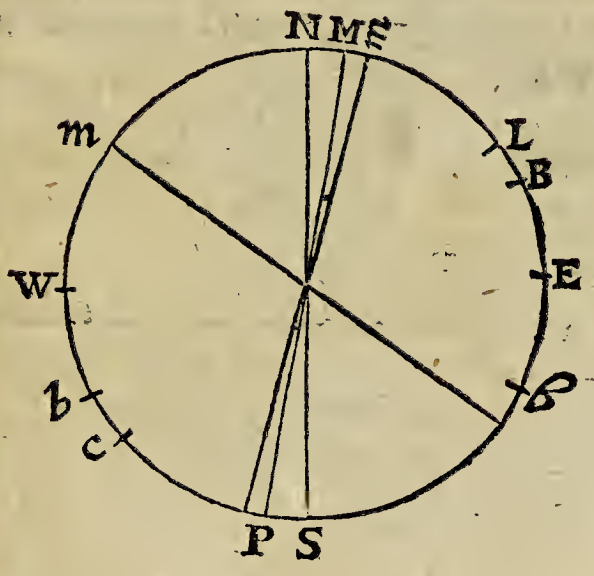
July 22, in 48 deg. 00 min. North Latitude, the Magnetical Amplitude at Sun-Riſing was obſerved to be 36 deg. 00 min. from the Eaſt Northward, what was the Variation, and which way?

The Declination then was 18 deg. 00 min. North.

Firſt, With this eighteen degrees, Declination and forty eight degrees Latitude, entring the Table of Amplitudes, page you'll find the true Amplitude to be twenty ſeven degrees, thirty minutes. Then having deſcribed the Circle, and quartered it, prick the true Amplitude from E, or the Eaſt-Point towards the North to B, and taking the Magnetical Amplitude thirty ſix degrees, prick that alſo from E Northward to C, and taking in the Compaſſes the diſtance between C and the North; ſet one foot in E, the Point of true Amplitude, and the other being turned towards the North, reaches to M, the Point to which the North Point of the Compaſs is directed, ſo that M N eight degrees, thirty minutes is the quantity of Variation, and becau

falls towards E, that is between N and E,
's Eaſtward.

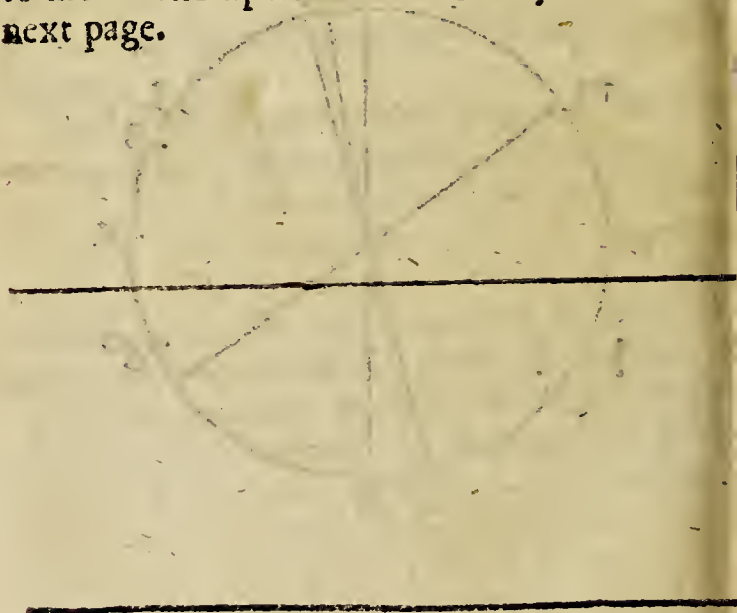
	D.	M.
M. Ampl.	36	00
True Ampl.	27	30
Variat.	8	30



Now if you take an old Compaſs-Card, and within this Circle, ſo that it's North and uth Line may lie on the Line M P, then

will this Compaſs-Card repreſent the varied Compaſs, and the Circle N E S W, the Horizon, or Compaſs without Variation, ſo that if you take with a pair of Compaſſes the diſtance between the North, or Point N of this outward Circle, and the Point of your Courſe on the varied Compaſs or Card, repreſenting it; and afterwards ſet one foot on M, the other will ſhew on the Compaſs-Card, amongſt the Points the true Courſe.

Or thus, you may have two Compaſs-Cards to move one upon the other, as you ſee in the next page.



North
East
South
West
NE
NEbE
NNE
NEbN
ENE
EbN
EBS
ESE
SEbE
SE
SEbS
SSE
SbE
SSW
SWbS
SW
WSW
WbS
NW
NWbW
NNW
NbW
NbE
NNE
NEbE
ENE
EbN
EBS
ESE
SEbE
SE
SEbS
SSE
SbE
SSW
SWbS
SW
WSW
WbS
NW
NWbW
NNW
NbW

And taking the true Amplitude from the graduated Limb, ſet it from the Eaſt Point (if the Obſervation be at Riſing) elſe Weſt Point of the under or fix'd Compaſs, either towards the North or South, according as the Amplitude is; prick alſo the Magnetical Amplitude thereon, after the ſame manner to C; then take the Diſtance between the Point of Magnetical Amplitude C, and the North Point of the lower, or fix'd Compaſs, prick it from B, the Point of true Amplitude to M, and bring the North Point of the Movable, or upper Compaſs to M; then if you look any Courſe on the upper Compaſs, the Point againſt it on the neather Compaſs is the True Courſe, & the contrary.

EXAMPLE II.

In the Latitude 41 deg. 00 min. North, the Sun having ſeventeen degrees, no minutes Declination South, the Magnetical Amplitude at Sun-ſet is obſerved to be thirty ſix degrees, no minutes from the Weſt Southward, What is the Variation, and which way is it?

By entring the Table of Amplitudes with the Latitude and Declination, as before directed the true Amplitudes will be found to be 22 deg. 47 min. which being pricked on the Circle from W (as before directed) to b, and alſo the Magnetical Amplitude to C.

M

	D.	M.
M. Am.	36	00
T. Am.	22	47
Var.	13	13

The distance between m N shews the Variation to be 13 degrees, thirteen minutes, and that Eastward from the North.

EXAMPLE III.

	D.	M.	
Let the Declination be	15	00	N.
The Latitude	50	00	N.
The Magnetick Amplitude at Sun-Rising.	29	00	S.

And it be required to find the Variation of the Compass.

Having described a Circle, and quartered it, prick the True Amplitude (which by the Table of Amplitude is found to be) twenty three degrees, forty four minutes, from the East Northward from E, the East Point towards the North to b, and the Magnetical Amplitude twenty nine degrees, no minutes from E Southward (according to the Observation) to c; then taking the distance between c the Magnetick Amplitude, and N the true North;

ſet it from b Northward, and it finds the Point M, the diſtance between M and N is fifty two degrees, forty four minutes, the Variation which is Weſtward, becauſe it falls between N and W.

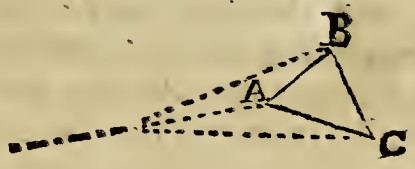
	D.	M.
M. Amplitude.	29	00
T. Amplitude.	23	44
Variation from the N. W.	52	44

Of this I ſhall ſhew more Examples afterwards.

How to find where Currents are, and which way they ſet, and their drift or rate of driving.

A good way to diſcover the great and moſt notable Currents, is by keeping an exact account of your way both outward and homeward according to your dead Reckoning, being very curious in obſerving the way your ſhip makes, by the Log-Line; for it is not your correct account, but your dead Reckoning that is here to aſſiſt you, therefore you muſt be careful to try how the ſhip goes by it when you ſail near the Meridian, how ſhe's drawn from her courſe; as again, when ſhe's ſteered directly Eaſt or Weſt, take good notice if ſhe alter her Latitude. As for thoſe gueſſing

by Ripplings of the water, and drawing of froth, *&c.* along the ſhoar, when in ſight of it, they can ſtand a man but in little ſtead. But the moſt uſual and uſeful way of obſerving a Current is thus; when there's a ſmooth Sea, and not much wind, have out the Boat, taking into her three or four hands, a Compaſs, a Log-Line, and half minute Glaſs, with a Line, or ſmall Warp of above an hundred Fathoms long, to the end of which Line faſten a triangular piece of Board, as the Board A B C:



And to one of the Angles faſten a good weight of Lead to ſink it: ſome uſe inſtead of this Board a Kettle tyed by the Bail.

When you are off from the ſhip, caſt over your Board or Kettle, letting it ſink, at leaſt ſixty Fathoms; but if you have Line enough let it go one hundred, or one hundred and 20 Fathoms; then belaying the Line faſt about her ſtem, it will bring her up, and make her ride as if at an Anchor. Then caſt over your

Log,

Log, turn up the Glaſs, and as you veer out the Log-Line, ſet the driff of the Log with your Compaſs, ſo ſhall you know whether there be any Current or not, and if any, how it's ſet and rate of driving, remembring to add always to the drif, if the Line ſhe ride by be 60 Fathoms one third part, if the line be 80 fat. one fourth part, but if one hundred Fathoms the one fifth part, *&c.* of the drift more for the drift of the Boat; for tho the Boat ſeem to ride, or lie ſtill, yet ſhe's found by experience to drive the mean time: but whether theſe Allowances be the very truth, I ſhall not much contend, yet are delivered as agreeing with experience, and therefore may be uſed till every ones experience better informs him; yet not that the bigger the Weight and Board is that the Boat is to be rid by, the leſs will be her drift.

Of Lee-way.

That you may be the better able to judge of a Ships Lee-way, always when you are by a Wind, and have Land in ſight juſt on Head, take notice as you keep the ſhip ſteered on the Point the Land bore on, how ſhe ſlides away to Leeward, and the Land appears ſtill more and more to Windward; for by ſuch kind of Obſervations, taking notice of the ſail abroad, ſtreſs of Wind, ſhip's trim, and growth of the Sea;

Sea, the Judgment may be ſo ſtrengthened, that a man ſhall rarely fail in giving a pretty true allowance.

If the Land in ſight be not right on Head, yet by taking notice of the point it was on at firſt, and how it weathers in keeping the ſame courſe, you have the ſame advantage to edifie your Judgment.

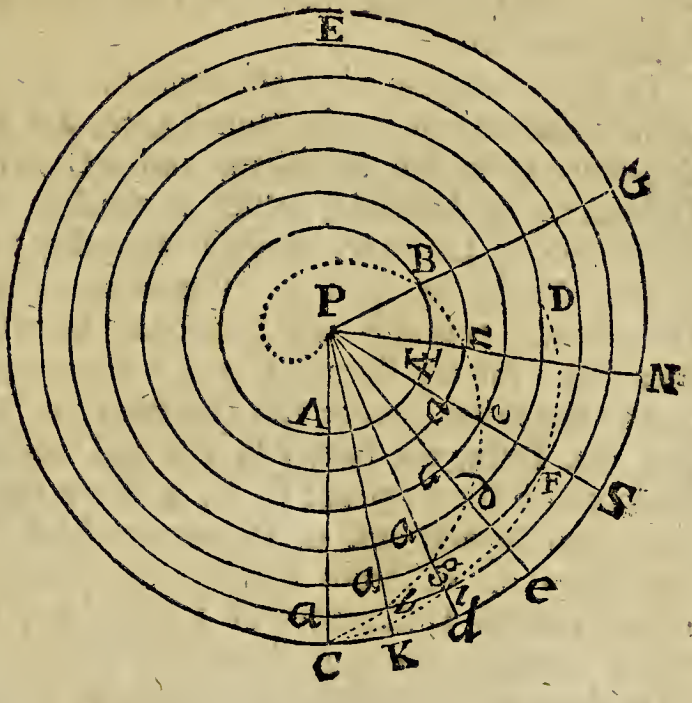
Of the Nature of the Line deſcribed, or the Ship's motion, when ſteered by a Rectified Compaſs on any oblique Point thereof, or Rumb.

The Rumb-Line is from the very nature of the Compaſs, by which it's traced, a Line that makes equal Angles with every Meridian through which it paſſes, and ſeeing the Meridians tend one to another till they meet in the Poles, muſt needs be a curving or bending Line; and for as much as no Circles but the Equinoctial and it's Parallels make, or can make equal Angles with all Meridians, it cannot be a Circle, but ſuch a Curve which ſome call an *Helix*, or becauſe on the ſurface of the Globe an Heliſpherical Line. It always tends nearer and nearer the Poles, and very near the Poles it turneth round the ſame often, in many twirls, Gyrations, or turnings. So that how ſmall a part ſoever thereof be taken, it will ſtill differ both

both from a right Line, and Arch of a Circle, yet the ſmaller the ſegment thereof is, the nearer it's to a Right Line.

Of the Nature of the Triangles made upon the Globe by the Rumb-Line, Meridians and Parallels of Latitude.

Let P repreſent the Pole of the Globe, all the ſtraight Lines drawn there-from, as P C, P K, P D, P E, P S, P N, P G Meridians; all the Concentrick Circles parallels to the Equinoctial, and they ſo many as there are minutes in the Meridian.



Let a ſhip be ſuppoſed to have kept a juſt North Eaſt Courſe from the Point C in the Equinoctial, and thereby to have drawn the Curve, or North Eaſt Rumb-Line, c, b, g, d, e, n, B, P approaching nearer and nearer the Pole as continued, and the foreſaid Meridians to be ſuch as paſs through the Points where this Rumb-Line croſſes the former Parallels. Then ſhall there be made by this Rumb-Line, the Meridians and Parallels certain ſmall Triangles, which

which we ſhall take to be right-angled, and ſtraight-lined, tho indeed they are neither; yet in a ſmall diſtance they are inſenſibly differing there-from.

In the Triangle c a b right-angled at a; c b is the diſtance run on the Rumb-Line, a b the departure from the Meridian, and a C is the Difference of Latitude, which is equal to the Difference of Latitude, made in any other part of the World by ſuch a diſtance run on the ſame Rumb, as is alſo the Departure from the Meridian: for the ſides b a, a g, a d are equal one to the other, as are alſo the ſides c a, b a, g a, d a, ſeeing the ſides c b, b g g d the diſtances with the Angles at C, b, g, d are equal. But equal Separations, or Departures from the Meridians on different Parallels of Latitude make various Differences of Longitude; for thirty Leagues Departure on the Parallel of ſixty degrees, no minutes of Latitude, makes three degrees, no minutes difference of Longitude, when thirty Leagues Departure on the Equator makes but one degree and a half; ſo that the ſide B, Æ, tho but equal to C K, makes twice as many degrees of Longitude; hence ariſeth one great error on the Plain Chart, by ſuppoſing, as it doth, that equal Departures on all Parallels make equal Differences of Longitude.

Note, that tho the ſides a b, a g, a d, a e be equal; yet a b is leſs than C K, and a g than

than b i, *&c.* so that in a critical sence, if a ship should return by the opposite Rumb she went, as from b to C, seeing the side C K, the Departure, returning, is greater than the side a b her Departure in going the Angle C B K, shall be greater than the Angle a C b, and consequently the ship should fall wide of C, nearer K, and not arrive at C, as may be experienced by resolving the two Triangles C a b, and b K C, yet this difference is so very little, that tho by numbers it may be discovered to be somewhat; in practice at Sea it can make no error, and a ship may return by the opposite Rumb, that error being only a speculative nicety.

In any of these Triangles having any two parts, the other may be found, as having C A the difference of Latitude with the Angle a c b the Course, the sides C b, the Distance, and a b the Departure, and consequently the Angle C P b the Difference, or Longitude may be found, or having the sides C b, a b, we may find the side C a, and the Angle a C b, *&c.* for it's other parts. In the whole Rumb, Triangle C a B C B is the whole distance, and C A the whole difference of Latitude, and the whole Departure from the Meridian is not given in any one Triangle, but in divers Triangles (being as much in one as in another) so that the whole Departure is the sum of a b, a g, a d, a c, a n, A B, and the whole

difference

difference of Longitude is the Arch C G, whose parts C K, K d, d e, e s are unequal.

Note also in all the Rumbs between the same Parallels, there's the same *ratio* of the Easting or Westing to the Degrees of Longitude, that is, letting the two Rumb-Lines C B, C D run till they cut the Parallel a, b, 1, E, I say that such proportion as a b, the Miles Easting or Westing made by the Rumb C, b, g, d, has to a 1, the Easting or Westing made by the second at the same Parallel of Latitude, such proportion has C K the Difference of Longitude made by the first Course to C d the difference of Longitude made by the second. And producing these Rumbs farther, till they cut the Parallel a, g, F, in g and F, then such proportion as a g has to a F, such has the Difference of Longitude K æ, to the difference of Longitude K s, or such as is the *ratio* of a g to g F, such is that of K d to d s. Hence I make any one Rumb supply all the rest in this business of Easting and Westing, as you may see in the last Examples of the Use of the Table.

Of

Of the Quantity of a Degree of a Great Circle on the Earth, and how it's found.

THere are many ways of discovering the quantity of a Degree on Earth; but none so natural and certain as that used by Mr. *Norwood*, which was to measure with all exactness possible, the distance between some two places, lying directly under the same Meridian, or North and South one of the other (the farther distant the better) and to compare that with the Degrees and Minutes in the Difference of the Latitudes of those two places; the Latitudes of both places being observed with all the niceness and curiosity imaginable.

By this means he found no less than three hundred sixty seven thousand two hundred of our English Feet to answer to a Degree of Latitude, which hath been farther since confirmed by many other experiments in our own Country, but the greatest confirmation is, that by the very same manner of experiment, *viz.* by measuring between two places under a Meridian in *France* hath been found three hundred sixty five thousand one hundred eighty four English Feet

Feet in a Degree. But Mr. *Norwood* conſidering that the ſhips way is more than is really given by the Log, and that it's more ſafe to have the Reckoning ſomewhat before the ſhip flang away the ſeven thouſand two hundred, retaining only threee hundred ſixty thouſand Feet to one degree, and conſequently ſix thouſand Feet to a minute, or one ſixtieth part of a Degree, according to which account there's of our Statute-Meaſure of five thouſand two hundred and eighty Feet to the mile, ſixty eight miles and two parts of eleven to a Degree, and of Engliſh Sea-miles, or Italian miles, of five thouſand Feet to the mile, ſeventy two miles, or twenty four Leagues in a Degree, and the whole Circumference of the Earth is eight thouſand ſix hundred and forty Leagues, which is one hundred and twenty Leagues leſs than the French Experiment makes it: and than really are.

Of the Eſtimation of a Ships way at Sea.

IN the now practice of Navigation there's hardly any thing more neceſſary than to be able to make a good Eſtimate of the ſhips way with

with any wind, according to all Circumstances.

For which many ways have been thought of by Wheel-works, *&c.* but to little purpose; the Nations now of Fame and Experience at Sea making better work with less craft. Some only guessing by the sail born, and running of the Froth or Water by the ship's side, as the Spaniards and Portuguese; others by flinging into the water a Chip, or the like; and counting how many equal timed paces they can make on the Deck, while the said Chip drives between any two Bolt-Heads or Marks on the side, which is usual amongst the Dutch; (instead of paces you may number the Pulses while the Chip drives:) but the most approved way, and now most followed is by our English Log, and Log-Line.

Of the Log and Log-Line.

The Log is only a piece of Wood, which being tied to a Line, and cast over-board, and the Line veered out as fast as the Log will carry it away, or as the ship sails, so that it may have leave to pull away as much Line as it can without being dragged by the ship any more than what the very weight of the Line will do, doth shew according to the time it's veering how much

much ſhe has ſailed, and conſequently her rate of ſailing.

This Line at about ten fathoms from the Log, which is allowed, that the Log may be out of the Eddy of the ſhips wake before the half minute, which is the time moſt commonly allowed for the veering the Line, begins to run, has a mark or knot for the beginning, and from thence is marked into ſpaces called Knots.

The ſpace of Line between Knot and Knot ought to be ſuch a part of a minute of a degree, as the half minute time is of an hour; ſo that the half minute being the one hundred and twentieth part of an hour, the length of Line between Knot and Knot ſhould be the one hundred and twentieth part of a minute of a deg. of a great Circle of this Globe of Earth and Water; and a minute being, as before proved, ſix thouſand Engliſh Feet: the length of Line between the Knots ought to be fifty Feet: but they are commonly knit at but ſeven fathoms, or forty two feet diſtance, grounding upon this error, that there's only three hundred thouſand Feet in a degree, and but five thouſand in a minute; yet it being ſtill found by the ſhips run, that this did not anſwer, they have leſſened their half minute by about five ſeconds, which brings it to the ſame thing in effect. Nevertheleſs, it were to be wiſhed, that the later, tho it ſerve a turn, might be omitted, and the true half minute brought in uſe, with the

Log-

Log-Line knit at it's true Lengths.

So many Knots as are veered in half a minute, ſo many miles the ſhip ſails in an hour, or ſo many Leagues, and ſo many miles in a Watch, or four hours.

So ſeven Knots in half a minute, is ſeven miles in the hour; eight Knots in half a minute is eight miles in an hour.

The Log is commonly thrown every two hours, but ſome throw it every hour.

Every noon, if poſſible, the Latitude ought to be obſerved; but whether Obſervation or none, the Maſter and his Mates then call for the Log-board, and add up the Knots and Fathoms run ſince the laſt Noon, the ſum ſhews the miles ſailed that twenty four hours, if the Log were caſt every hour; but if it were caſt but once in two hours, they double the ſum of the Knots run, and that ſhews the miles ſailed: if you would have the Leagues ſailed, divide by three: but the keeping the Reckoning in miles is to be preferred before that in Leagues. By a League here underſtand not three Italian or Engliſh miles, but three ſuch miles as ſixty of them will make a Degree, that is there ſuch miles, ſixty whereof are equal to ſeventy two Italian Miles.

This Account ruff taken off the Board, ought to be entred in a Book called the Traverſe-Book, or Log-Book; and afterwards the Traverſe from the laſt day noon being worked,

and

and the difference of Latitude and Departure found, and corrected by Obſervation, if any made, muſt be entred fairly in another Book, called the Journal.

Of the Log-Book and Journal.

THe Log-Book is to repreſent the Waſte-Book in Accounts, and ought to contain all requiſite Occurrences, as the Wind and Point of the Compaſs your ſhip lyeth upon, and what allowance you make for Lee-way, all bearing up, lyings by, ſight and bearings of Land, ſoundings, the knots and fathoms run each hour, the Latitude and Variation of the Compaſs, *&c.*

The Journal is to repreſent the Ledger or Fair-Book, and ought to contain the correct Accounts, which may be contained in nine Columns; in the firſt is the Month and Day, in the ſecond, the obſerved Latitude; in the third, the correct Courſe; in the fourth, the correct diſtance; in the fifth, the Northings; in the ſixth, the Southings; in the ſeventh, the Eaſtings; in the eighth, the Weſtings; in the ninth, the Departure, if kept according to the Plain Chart, or elſe the difference of Longitude.

At

At any time, when you'll know the ſhips place, put the Northings and Eaſtings as Creditors, and the Southings and Weſtings as Debtors, and you'll find inſtead of the ballance, that which will ſhew the ſhips place.

Sailing by the Arch of a Great Circle.

THis, tho it ſhew the neareſt way and diſtance between two places, yet cannot come ſo much in uſe as the two former kinds of ſailing; men being drawn from it by conveniences of Winds and Currents; or elſe forced from it by croſs Winds, or interpoſition of ome Head-Lands, Shouls, or Iſlands, *&c.* nd therefore I ſhall not ſpend much time on , but adviſe all to the Mercator. Only note, hat by having skill herein, you may ſee that 's many times the nearer way to leave the umb, and to ſail into a greater Latitude.

As in ſailing from the Lands end of *England* or *New Found-Land*, there's great advantage in he diſtance to raiſe and depreſs the Pole ten or welve degrees, beſides a benefit it yields in ctifying the Account. And that many times hen the account is kept by the Plain Chart, nd the ſhip ſails not home as ſhe went out, that

either the going, or returning being the one nearer to a great Circle than the other, cauſes a great difference, and the diſtance one way greater than the other; ſo that returning from the Weſt *Indies*, the ſhips fall with the Lands End, or many Leagues before they come, to their great hazard.

If the two places over which the great Circle is to paſs, be both under the Equinoctial, the Equinoctial is the great Circle, and the difference of Longitude between the two places is the diſtance, and the Courſe between is directly Eaſt or Weſt.

If the two places lie both under one Meridian, that is directly North and South, and the one of them ſituate under the Equinoctial, then are the degrees of Latitude of the other the diſtance.

If both places be under the ſame Meridian, and both have Latitude of the ſame Denomination, that is both North, or both South then the difference of Latitude turned into miles is their diſtance.

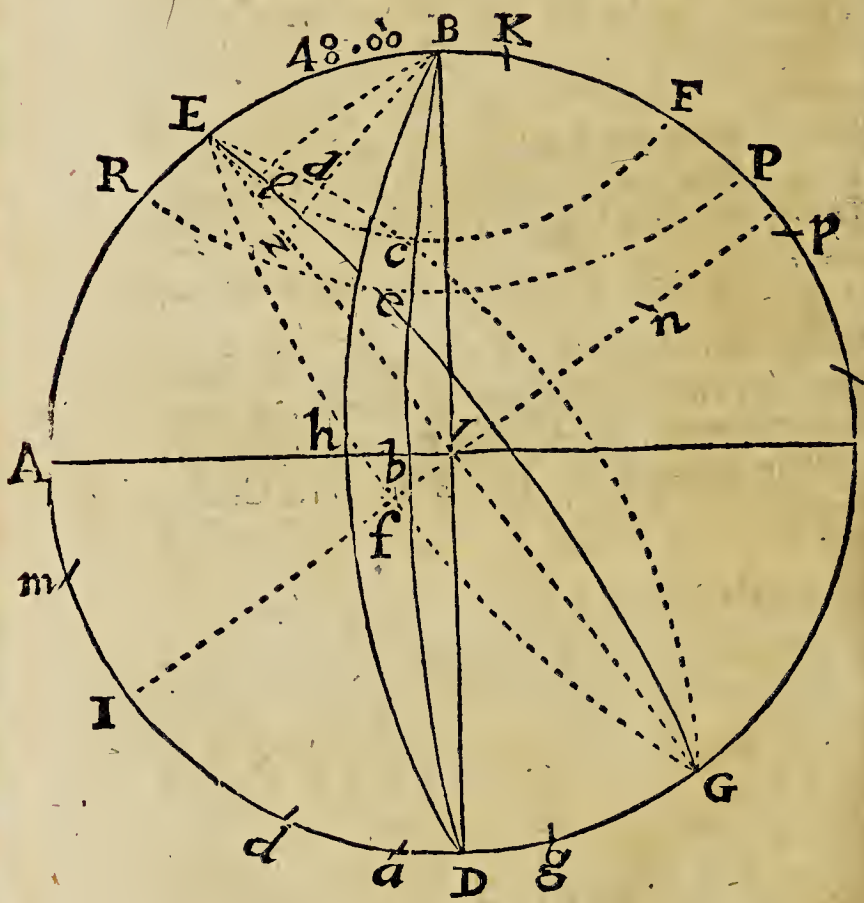
If both places lie under the ſame Meridian but have Latitude, the one North, and the other South, then the ſum of the Latitudes of both places is the diſtance, unleſs the diſtance be above one hundred and eighty degrees.

Propoſition

Propositions of Great-Circle-Sailing.

The Difference of Longitude of two places both under the same Parallel of Latitude being given, to find the Great Circle Distance between them, and the Angles of Position, or Bearing.

Admit two places in the Latitude, fifty four degrees, no min. differing in Longitude 79 degrees, thirty minutes; and it be required to find their Distance by the Arch of a Great Circle.



Descril

Deſcribe a Circle, as A B C D; as it is in the foregoing page, and quarter it with two Diameters A B, C D, at right Angles one to the other then prick the Difference of Longitude from A to a, and laying a Rular over B a, find the Point b, and deſcribe the Arch B b D. Afterwards prick the Latitude from A to E, and from C to F, and by laying a Rular over E C, find the Point, and deſcribe the Arch E C F.

Laſtly, Draw the ſtraight Line E V C, and deſcribe the Arch E C G. A B C D repreſents the Meridian of one of the places; B b D the Meridian of the other, E c F the Parallel of Latitude; B D one Pole; D the other; B D the Axis; A V C the Equinoctial; E the one place; c the other; E c G the great Circle paſſing over both places.

Arithmetick.

In the Equicrural Spherical Triangle E B C, is given the Angle E B C the difference of Longitude, and the two ſides E B, and B C, each equal to the Colat. to find the Angles E and C, and the ſide E C.

From B imagine a Perpendicular to be let fall to the Arch.

From B imagine a Perpendicular, B d to fall on the Arch E C, which will divide the Triangle E B C into two right-angled Triangles E d B, C d B.

To find the side E C, the Great Circle Distance.

In either of the right-angled Triangles EDB
e d B are given the side E B, and Angle EB
the half difference of Longitude to find E d
the half Arch E C. Here E B is the mean
and E d, and Angle B adjacent extreams, on
whereof is sought, therefore say

As the Radius	10,000000
Is to the sine of E B or B C 36 deg. 00 min.	9,769219
So is the sine of 39 deg. 45 m. being the half Ang. EBc, the half difference of Long. to the sine of 22 deg. 5 min.	9,805799
	19,575018
The half of E C the Great Circle Dist. whence the great Circle Dist. is 44 deg. 10 min.	or 2650 mil

But the distance according to the Rumb, o
on the Parallel is 2804 m.

For the Angles of Position, or Bearings.

In the right-angled Triangle E d B is give
the side E b the Colat. and Angle E B d th
half difference of Longitude, to find the An
gle B E D. E B is the mean, and the tw
Angl

Angles d E B, E B d are extreams adjacent, one of which is required: therefore say

As the fine of 54 degrees the Latitude ——— } 9,907958

Is to the Cotang. 39 deg. 45 m. the half difference of Longitud. } 10,080038

So is the Radius ——— 10,000000

To the Tang. of 56 deg. 03 min. the Angle of Poſition. } 20,080038 / -9,907958

10,172080

Which gives North Weſt by Weſt.

To find the greateſt Latitude the Arch ſhall paſs through.

In the right angled Triangle EdB, are given the ſide EB, and Angle EBd, to find the ſide. d B the Complement of the greateſt Latitude The Angle E B d is the mean, and the two ſides EB, B d are extreams adjunct, one whereof is ſought, beginning with the other ſay,

As the Cotang. of E B 36 deg. 00 min.
Is to the Radius ——————
So is the Cosine of Angle EBd 39 deg. 45 m.
To the Tang. of dB the
Complement of the greatest Latitude.

The Latitudes of two places lying in the same Hemisphere, their Difference of Longitude being given to find the great Circle Distance between them and the Angles of Position.

Admit the *Lizard* in Latitude 50 deg. 00 m. North, and Cape *Cod* in the Latitude 42 deg. 20 min. North, and their difference of Longitude to be *66* deg. 00 min.

Having described a Circle, and quartered it, lay the Latitude of the *Lizard* from A to E, and draw E V, and the Latitude of Cape *Cod* from A to R, and from C to P, and describe the Arch R P, then prick the difference of Longitude sixty six degrees from A to d, and laying a Rular over Bd find the Point h, and describe the Arch BkD. Lastly, through E e G describe an Arch which shall be the great Circle passing over both places, E represents the *Lizard*, e Cape *Cod*, E e the great Circle Distance between them.

Arithmetick.

In the Oblique Spherical Triangle E B e is given, the Angle B the difference of Longitude, the side E B the Colat. of the *Lizard*, and the side B e the Colat. of Cape *Cod*, to find the Angles E and e, and the side E e.

	D.	M.	
E B	40	00	
e B	47	40	
2)	87	40	
	43	50	Half sum of sid. giv.
2)	7	00	
	3	30	Half diff. of sid. giv.

As the sine of 43 deg. 50 min. the half sum — 9,840459

Is to the sine of 3 deg. 30 min. the half diff. — 8,785675

So is the Corang. of 33 deg. 00 min. the half contained Ang. — 10,187483

18,973158

To the Tang. 7 deg. 44 m. the half diff. of 2 unknown Ang. — 9,132699

As the Cosine of 43 deg. 50 min. } 9,858150

Is to the Cosine of 3 degrees, 30 min. } 9,999189
So is the Cotang. of 33 deg. no min. } 10,187483

To the Tangent of 64 deg. 51 min. the half sum of the unknown Angles. } 20,186672 / 10,328522

D.	M.
64	5
7	44

The greater Ang. 72 35 or Ang. of Cap. bear.

The Angle of 57 07 the *Lizard's* bearing.

Now say,
As the sine of the Angle E 72 deg. 35 min. } 9,979618

Is to the sine of 47 deg. 40 m. B C. } 9,868785
So is the sine of 66 deg. Ang. B. 9,960730

To the sine of E c 45 deg. 03 min. the great Circle Distance. } 19,829515 / 9,849897

Which

Which makes 2703 miles; but the distance according to the Mercator's Chart is 2778, and the bearing of Cape *Cod* from the *Lizard* is, West by South neareſt.

To find the greatiſt Latitude the Arch ſhall paſs through.

In the right-angled Triangle E Z B right-angled at Z is given the Angle Z E B, and the ſide EB to find the ſide ZB, which is the Complement of the greateſt Latitude, and the Angle E B Z. Afterwards if you would find the Latitudes, this Arch ſhall paſs through at every ſecond, third, or fifth degree from either E or e, by ſubſtracting the two, three, or five degrees, *&c.* continually from the Angle E B Z, you will have in the right-angled Triangles 1 B Z, the Angles 1 E Z, and ſide Z B, to find the ſides 1 B the Colat. and Angle 1 the bearing.

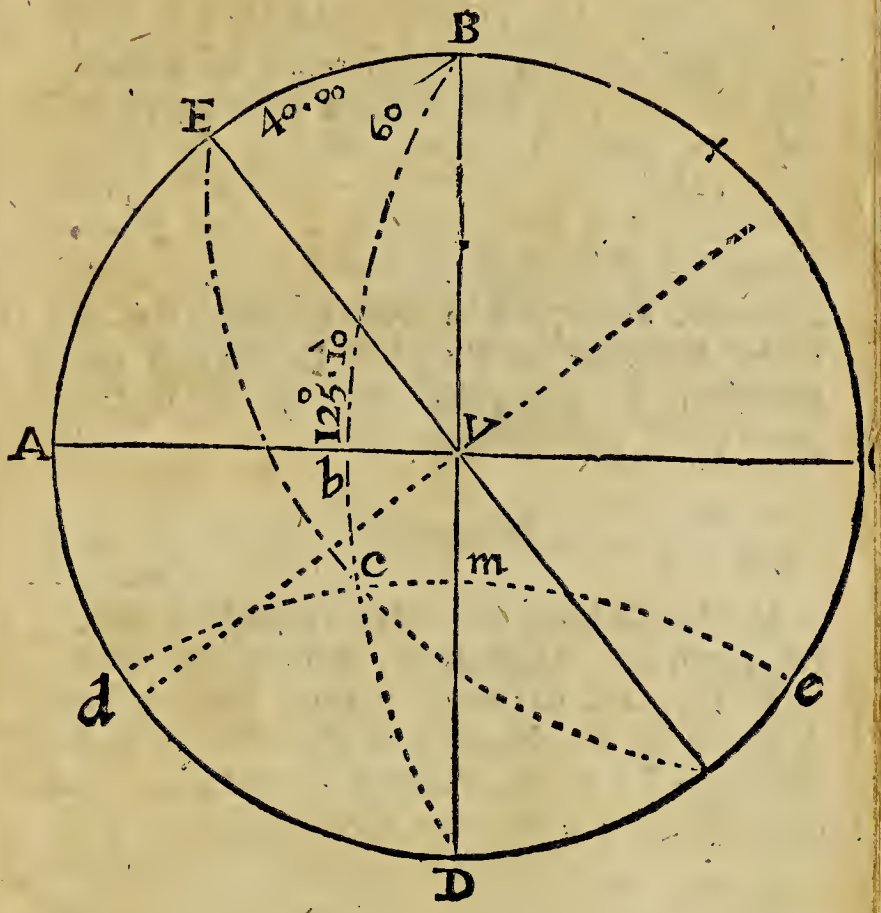
If you would find the difference of Longitude, and Angle of Poſition, or Courſe at every degree Alteration of Latitude, then in the right-angled Triangle 1 Z B, is given the ſides Z B and 1 B to find the Angle Z 1 B the courſe, of Angle 1 B Z the difference of Longitude from the Perpendicular, and you may find the ſide z 1 the diſtance to be ſailed in making that Alteration.

If

If you'll find the Latitude and Longitude she is in, which the Course shall be allowed one quarter, or half a Point, *&c.* In the right-angled Triangle l z B is given the side Z B, and Angle z l B, to find the Angle l B Z the diffence of Longitude, from the Perpendicular, the side lB the Colat. and the side l z the distance.

The Latitudes of two places the one on the one side, and the other on the other side of the Equinoctial, and their difference of Longitude being given to find the Great Circle distance between them.

Two places, the one in 50 deg. no min. Lat. North, the other in 35 deg. 10 min. South Latitude, differing in Longitude 60 degrees.


B
E
40.00
60
125.10
A
V
b
C
m
d
e
D

Having described a Circle, and quartered it with two Diameters, at right Angles prick 50 degrees the one Latitude from A to E. Then prick 35 degrees 10 minutes from A to d, and from C to E. Lay a Rular over A e, and find the Point m. Then describe the Arch d m e, prick sixty degrees, the difference of Longitude from A to a, and laying a Rular over B a, find the point b. Then describe the Arch BbD. Lastly, draw the straight line EVG, and describe the E c G. Then is A C the Equinoctial B D it's Poles, E the place in North Latitude, e the place in South Latitude, B E A is the Meridian of the place E, B c b D the Meridian of the plece C, E c G is the great Circle passing both places.

Arithmetick.

In the Oblique spherical Triangle E B c, are given the Angle B 60, and the two sides B E 40, B C 125 deg. 10 min. to find the Angles BEc, the Bearing of the place c, and the Angle B c E the Bearing of the place c, and the side E c the great Circle Distance.

FINIS.

Books sold by Obadiah Blagrave *at the* Bear *in S.* Paul's *Church-Yard.*

THe New World of Words, being a general Englisſh Dictionary, containing the Interpretations of all hard Englisſh Words; with an Explanation of all Terms of Art, in any of the Arts and Sciences. By *E. Philips.* In *Folio.*

Dr. *Robert Gell*'s Famous Notes and Obſervations on the whole New Teſtament. In two Volumes. *Folio.*

Mr. *Richard Saunders*'s Large Book of Phyſiognomy and Chiromancy, with the Explanation of the Moles of the Body, ſhewing the ſignification of Dreams, with an Art of Memory. In *Folio.*

Cocker's Large Copy-Book, called *England's Pen-man*, containing twenty eight Copper Plates of all the curious Hands now writ and practiſed.

J. Gadbury's Ephemerides for ten years paſt, and twenty years yet to come, and unexpired. In *Quarto.*

Blagrave's

Blagrave's Introduction to Aſtrology, being the Remainder of his Aſtrological Works, formerly promiſed by him to publiſh in his Book called the *Aſtrological Practice of Phyſick*. In Large *Octavo*.

Blagrave's Supplement to Mr. *Nicholas Culpepper*'s Engliſh Phyſician; ſhewing the Virtues of ſuch Herbs as were omitted by him; Printed ſo as that it may be bound with his *Engliſh Phyſician*. In Large *Octavo*.

Culpepper's Laſt Legacy, left and bequeathed to his dear Wife for the publick good; being his choice Secrets in Phyſick and Chyrurgery. In Large *Octavo*.

Culpepper's School of Phyſick, or the experimental Practice of the whole Art, wherein are contained Remedies for all Diſeaſes, both inward and outward. In Large *Octavo*.

Culpepper's Aſtrological Judgment of Diſeaſes. In Large *Octavo*.

De Succo Pancreatico, or a Phyſical and Anatomical Treatiſe of the Nature and Office of the Pancreatick Juice or ſweet Bread in Man, Illuſtrated with Copper Cuts. In Large *Octav.* By that famous Phyſician *De Graff*. Tranſlated from the Latine.

Praxis Catholica, or the Countryman's Univerſal Remedy: wherein is plainly ſet down the Nature of all Diſeaſes, with their Remedies. In *Octavo*.

FINIS.

A *Traverſe Table* to every *Quarter-point* of the *Compaſs*, to be placed after thoſe Tables that follow the *Sines* and *Tangents* before the *Signature D.*

This Table is explained and exemplified in the 3*d.* Chapter, beginning at page 101, and ſo on to page 112 and 113, of the *Tutor to Navigation.*

A Traverse Table for every Point, half Point, and quarter Point of the Compass, to the 100 part of a League or Mile, which gives the difference of Latitude and departure from the Merid.

Leagues or miles sailed	O R ¼ 2 d. 49 m.				O R ½ 5 d. 38 m.			
	N	S	E	W	N	S	E	W
1	01	00	00	05	00	99	00	10
2	02	00	00	10	01	99	00	20
3	03	00	00	15	02	98	00	29
4	04	00	00	20	03	98	00	39
5	04	90	00	25	04	97	00	49
6	05	90	00	29	05	97	00	59
7	06	90	00	34	06	97	00	69
8	07	90	00	39	07	96	00	78
9	08	90	00	44	08	96	00	88
10	09	90	00	49	09	95	00	98
20	19	97	00	98	19	90	01	96
30	29	96	01	47	29	85	02	94
40	39	95	01	96	39	80	03	92
50	49	94	02	45	49	75	04	90
60	59	92	02	94	59	71	05	88
70	99	91	03	43	69	66	06	86
80	79	90	03	92	79	61	07	84
90	89	89	04	41	89	56	08	82
100	99	87	04	90	99	51	09	80
200	199	86	09	80	199	02	19	60
	E	W	N	S	E	W	N	S
	87 d. 11 m.				84 d. 22 m.			
	7 R ¾				7 R ½			

A Traverse Table for every Point, half Point, and quarter Point of the Compass, to the 100 part of a League or Mile, which gives the difference of Latitude and departure from the Merid.

0 R ¾				1 Rumb.				Leagues or miles sailed
8 d.		26 m.		11 d.		15 m.		
N	S	E	W	N	S	E	W	
00	99	00	15	00	98	00	20	1
01	98	00	29	01	96	00	39	2
02	97	00	44	02	95	00	58	3
03	95	00	59	03	92	00	78	4
04	95	00	73	04	90	00	98	5
05	94	00	88	05	88	01	17	6
06	92	01	03	06	86	01	37	7
07	91	01	17	07	85	01	56	8
08	90	01	32	08	83	01	70	9
09	89	01	47	09	81	01	95	10
19	78	02	93	19	61	03	90	20
29	67	04	40	29	41	05	85	30
39	54	05	86	39	22	07	80	40
49	45	07	33	49	03	09	75	50
59	35	08	80	58	84	11	70	60
69	24	10	27	68	65	13	65	70
79	13	11	73	78	46	15	60	80
89	02	13	20	88	27	17	55	90
99	91	14	67	98	08	19	50	100
197	82	29	34	196	16	39	00	200
E	W	N	S	E	W	N	S	
81 d.		34 m.		78 d.		45 m		
7 R ¼				7 Rumb.				

A Traverse Table for every Point, half Point, and quarter Point of the Compass, to the 100 part of a League or Mile, which gives the difference of Latitude, and departure from the Merid.

Leagues or miles sailed	1 R ¼ 14 d. 4 m. N	S	E	W	1 R ½ 16 d. 52 m. N	S	E	W
1	00	97	00	24	00	96	00	29
2	01	94	00	48	01	91	00	58
3	02	91	00	37	02	87	00	87
4	03	88	00	97	03	83	01	16
5	04	85	01	21	04	78	01	45
6	05	82	01	46	05	74	01	74
7	06	79	01	70	06	70	02	03
8	07	76	01	94	07	65	02	32
9	08	73	02	19	08	61	02	61
10	09	70	02	43	09	56	02	90
20	19	40	04	85	19	13	05	80
30	29	10	07	28	28	70	08	70
40	38	80	09	71	38	27	11	61
50	48	50	12	14	47	84	14	50
60	58	20	14	57	57	41	17	41
70	67	90	17	00	66	98	20	31
80	77	60	19	43	76	55	23	22
90	87	30	21	86	86	12	26	12
100	97	00	24	29	95	69	29	02
200	194	00	48	58	191	38	58	04
	E	W	N	S	E	W	N	S
	75 d.		56 m.		33 d.		7 m.	
	6 R ¾				6 R ½			

A Traverse Table for every Point, half Point, and quarter Point of the Compass, to the 100 part of a League or Mile; which gives the difference of Latitude and departure from the Merid.

1 R ¾				2 Rumb.				Leagues or miles sailed
19 d.		41 m.		22 d.		30 m.		
N	S	E	W	N	S	E	W	
00	94	00	33	00	92	00	38	1
01	88	00	67	01	85	00	76	2
02	82	01	01	02	77	01	15	3
03	77	01	35	03	70	01	53	4
04	71	01	68	04	62	01	94	5
05	65	02	02	05	54	02	30	6
06	59	02	36	06	47	02	63	7
07	58	02	69	07	39	03	06	8
08	47	03	03	08	31	03	44	9
09	41	03	37	09	24	03	83	10
18	83	06	73	18	47	07	65	20
28	24	10	10	27	71	11	48	30
37	66	13	47	36	95	15	30	40
47	07	16	84	46	19	19	13	50
56	14	20	21	55	43	22	36	60
65	90	23	58	64	67	26	78	70
75	32	26	95	73	91	30	61	80
84	73	30	32	83	14	34	44	90
94	15	33	68	92	38	38	26	100
188	30	67	36	184	76	76	52	200
E	W	N	S	E	W	N	S	
70 d.		19 m.		57 d.		30 m.		
6 R ¼				6 Rumb.				

A Traverse Table for every Point, half Point, and quarter Point of the Compass, to the 100 part of a League or Mile; which gives the difference of Latitude and departure from the Merid.

Leagues or miles sailed	2 R ¼				2 R ½			
	25 d. 19 m.				28 d. 8 m.			
	N	S	E	W	N	S	E	W
1	00	90	00	43	00	88	00	47
2	01	87	00	85	01	76	00	94
3	02	71	01	28	02	54	01	41
4	03	61	01	71	03	43	01	89
5	04	52	02	14	04	31	02	36
6	05	42	02	56	05	29	02	83
7	06	33	02	99	06	17	03	30
8	07	23	03	42	07	05	03	77
9	08	14	03	85	07	94	04	24
10	09	04	04	28	08	82	04	71
20	18	07	08	55	17	63	09	42
30	27	11	12	82	26	45	14	14
40	36	15	17	10	35	27	18	85
50	45	19	21	37	44	09	23	56
60	54	23	25	67	52	91	28	28
70	63	27	29	92	61	73	32	99
80	72	31	34	20	70	55	37	71
90	81	35	38	47	79	37	42	43
100	90	39	42	75	88	19	47	13
200	180	78	85	50	176	38	94	26
	E	W	N	S	E	W	N	S
	64 d.		41 m.		61 d.		52 m.	
	5 R ¾				5 R ½			

A Traverse Table for every Point, half-Point, and quarter Point of the Compass, to the 100 part of a League or Mile; which gives the Difference of Latitude and departure from the Merid.

2 R ¾				3 Rumb.				Leagues or miles sailed
30 d.		56 m.		33 d.		45 m.		
N	S	E	W	N	S	E	W	
00	86	00	51	00	83	00	55	1
01	71	01	03	01	66	01	11	2
02	57	01	54	02	49	01	67	3
03	43	02	06	03	32	02	22	4
04	29	02	57	04	16	02	78	5
05	15	03	08	04	99	03	33	6
06	00	03	60	05	82	03	89	7
06	86	04	11	06	65	04	44	8
07	72	04	63	07	48	05	00	9
08	58	05	14	08	31	05	55	10
17	15	10	28	16	62	11	11	20
25	73	15	42	24	94	16	66	30
34	30	20	56	33	29	22	22	40
42	88	25	70	41	57	27	77	50
51	46	30	84	49	88	33	33	60
60	04	35	98	58	20	38	88	70
68	61	41	12	66	51	44	44	80
77	19	46	26	74	83	50	00	90
85	77	51	41	83	14	55	55	100
171	54	102	82	166	28	11	11	200
E	W	N	S	E	W	N	S	
59 d.		4 m.		56 d.		15 m.		
5 R ¼				5 Rumb.				

A Traverse Table for every Point, half-Point, and quarter-Point of the Compass, to the 100 part of a League or Mile, which gives the difference of Latitude and departure from the Merid.

Leagues or miles sailed	3 R ¼ 36 d. 34 m.				3 R ½ 39 d. 22 m.			
	N	S	E	W	N	S	E	W
1	00	81	00	60	00	77	00	63
2	01	61	01	19	01	55	01	27
3	02	41	01	79	02	32	01	90
4	03	21	02	38	03	09	02	54
5	04	02	02	98	03	86	03	17
6	04	82	03	57	04	64	03	81
7	05	62	04	17	05	41	04	44
8	06	43	04	76	06	18	05	07
9	07	23	05	36	06	96	05	71
10	08	03	05	96	07	73	06	34
20	16	06	11	91	15	46	12	68
30	24	09	17	87	23	19	19	03
40	32	12	23	82	30	92	25	37
50	40	16	29	78	38	65	31	71
60	48	19	35	74	46	38	38	06
70	56	22	41	69	54	11	44	41
80	64	25	47	65	61	84	50	75
90	72	28	53	61	69	57	57	09
100	80	32	59	56	77	30	63	43
200	160	64	119	12	154	60	126	86
	E	W	N	S	E	W	N	S
	53 d.		26 m		50 d.		27 m	
	4 R ¾				4 R ½			

A Traverse Table for every Point, half-Point, and quarter-Point of the Compass, to the 100 part of a League or Mile; which gives the difference of Latitude and departure from the Merid.

3 R ¾				4 Rumb.				Leagues or miles sailed
42 d.		11 m.		45 d.		05 m		
N	S	E	W	N	S	E	W	
00	74	00	67	00	71	00	71	1
01	48	01	34	01	41	01	41	2
02	22	02	01	02	12	02	12	3
02	96	02	69	02	83	02	83	4
03	70	03	36	03	54	03	54	5
04	44	04	03	04	24	04	24	6
05	18	04	70	04	95	04	95	7
05	93	05	47	05	66	05	66	8
06	67	06	04	06	36	06	36	9
07	41	06	72	07	07	07	07	10
14	81	13	43	14	14	14	14	20
22	22	20	14	21	21	21	21	30
29	63	26	86	28	28	28	28	40
37	04	33	57	35	35	35	35	50
44	45	40	29	42	42	42	42	60
51	85	47	00	49	49	49	49	70
59	26	53	72	56	56	56	56	80
66	67	60	44	63	63	63	63	90
74	08	67	15	70	70	70	70	100
148	16	134	30	141	14	141	14	200
E	W	N	S	E	W	N	S	
47 d.		49 m.		45 d.		0 m		
4 R ¼				4 Rumb.				

THis Table is one of the moſt uſeful, in the Art of Navigation, eſpecially in *plain Sailing*, and keeping a Reckoning at Sea; and altho the Uſe of it is ſhewed in the 3*d*. Chapter, *viz*. of *Traverſes*, yet to make it more Intelligible to the Learner, obſerve that 'tis made to every *Quarter-point* of the *Compaſs*, and 100*th*. part of a Mile Diſtance Run, thereby to give the *Latitude* and *Departure*. *viz*. If the Courſe be under 4 Points from the *Meridian*, then ſeek it in the top of the Table, and the Miles ſailed, in the firſt Column to the Left-hand, and in the common Angle of meeting under the Letters N. S. you have the *Difference of*

Latitude

Latitude in Miles or Leagues, and 100 Parts; and under E W, is the *Departure* from the *Meridian*. But if the Courſe be above 4 Points from the *Meridian* (*viz.* North and South) then ſeek the *Point* at the bottom of the Table, and the Diſtance ſailed, in the laſt Column to the Right-hand upwards, and in the Angle of meeting, over the Letters E W, at the bottom you have the *Departure*, and over the Letters N S, the *Difference of Latitude* in the Sailing this your Courſe and Diſtance. If you cannot find your diſtance Run at one Entrance, you muſt make ſeveral Entrances, and ſet down the *Difference* of Latitudes, and *Departures* Correſpon-

85-144

respondent; and laſtly caſt them up, and the *Aggregate* thereof will be your deſired *Difference* of *Latitude* and *Departure*, as is very obvious to a mean Capacity by the following Examples from page 101, to page 113, *&c.* Now the Proportion by which this excellent Table is made, you may find in the firſt Caſe of Plain-Sailing, Page 83.

D682
P448s

KC cc 7/8f

[2], 47 [1], [6], [12], [8]
[49]-260, [4] pp

H-790